


*A. Gould, Photo*

*Woodburytype.*

JOHN R. MUMMERY, I.D.S., ENG.





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THE  
UNIVERSITY  
OF LEEDS

TRANSACTIONS

OF THE

Odontological Society of Great Britain.



VOL. XIX.—NEW SERIES.





TRANSACTIONS  
OF THE  
ODONTOLOGICAL SOCIETY  
OF  
GREAT BRITAIN.



VOLUME XIX.—NEW SERIES.

LONDON:

Printed and Published for the Society by  
HARRISON AND SONS, ST. MARTIN'S LANE, W.C.,  
PRINTERS IN ORDINARY TO HER MAJESTY.

1887.

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UNIVERSITY  
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PRINTERS IN ORDINARY TO HER MAJESTY  
ST. MARTIN'S LANE.



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# Odontological Society of Great Britain.

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## ORDINARY MONTHLY MEETING.

The following nominations are now under the consideration of the Council :—

HENRY DAVIS, M.R.C.S., 157, Gower Street,  
W.C.

DANIEL BROWNING, L.D.S.Eng., 27, Upper Montague Street, W.

FRANK H. BRIGGS, L.D.S.Edin., 5, Park Crescent,  
Torquay.

WILLIAM EDMUND JAMES, L.D.S.I., Kingston-on-Thames.

*was formally admitted to membership by the President.*

The following candidates were then balloted for and elected members of the Society, viz.:—

MESSRS. HUMPHRY WINGFIELD TRACY, L.D.S.EDIN., 6,  
Hatter Street, Bury St. Edmunds;

PETER CRANK, L.D.S.Eng., 7, Castle Street,  
Canterbury;

ALBERT J. KUTZ, L.D.S.I., D.D.S., 32, Wimpole  
Street, Cavendish Square, W.

The PRESIDENT then announced that it was proposed by the Council that Mr. G. A. Ibbetson should be elected an Honorary

Member. He felt sure that all would be pleased thus to recognise the services of an old and faithful member, and one who was so well known and so highly respected. After the way in which the announcement had been received it seemed to him that it would be an empty form to send round the ballot box again, and that the resolution of the Council might well be confirmed in a more expeditious manner.

MR. DENNANT proposed that the election should take place on this occasion by show of hands.

This having been seconded by MR. STORER BENNETT, and agreed to, MR. GEORGE AUGUSTUS IBBETSON was unanimously elected an Honorary Member.

The PRESIDENT said he was sorry to have to state that he had received letters from two officers of the Society, the Treasurer and the Librarian, who regretted their inability to be present owing to illness. Happily both seemed to be doing well, and he hoped would soon be back in their places. He understood that Mr. Henri Weiss would announce, on behalf of his father, the additions which had been made to the Library since the last meeting.

MR. HENRI WEISS reported that no very important donations to the Library had been received during the vacation, the principal being the Calendar of the Royal College of Surgeons and a volume of Transactions of the Smithsonian Institute.

The CURATOR (MR. STORER BENNETT) reported that since the last meeting of the Society, six specimens had been received for the Museum. For three of these they were indebted to Surgeon G. M. Giles, Indian Medical Service, Chitral, Kafiristan, who had forwarded a case of specimens to the Museum of the Royal College of Surgeons, and asked Mr. Stewart, the Curator, to forward to the Odontological Society the crania of two Ibices (*Capra ibex*),—unfortunately the lower jaws were not included,—and the skull of one of the Felidæ, probably a black leopard (*Felis pardus*).

Mr. Dunn, of Florence, had sent two very interesting

specimens, viz., an upper and lower jaw, which he believed to have been found in an ancient Etruscan tomb, which would indicate their age as about 2,500 years. They were very chalky and fragile, and had apparently belonged to different individuals.

The upper jaw was rather small, and contained the incisors, canines, and bicuspid on both sides, with the first and second right molars, the tuberosity with the wisdom tooth having been broken away; the whole of the molar region on the left side had likewise been destroyed. The teeth, which were small, showed considerable marks of wear, but no trace of caries; some slight absorption of the alveolus round the necks of the teeth had taken place, though there was hardly a trace of tartar to be discovered. The incisors were set almost in a straight line across the face, the canines and posterior teeth, also in a straight line, being at an obtuse angle to the incisors; thus there was no curved outline to the alveolus at all.

Unlike the upper jaw, the lower one, which consisted of the horizontal ramus, presented a well-shaped arch containing the incisors, canines, and bicuspid, on both sides, with the first molar and socket of the second on the right side; the rest of the specimen being missing. The teeth, which were considerably worn, presented the dark appearance so often seen where rapidly advancing caries has been suddenly arrested, redeposition of lime salts subsequently taking place, giving an almost enamel-like hardness to the superficial layer of dentine. The teeth had evidently been exposed to the friction engendered by an edge-to-edge bite. Absorption of the alveolus had taken place to a greater extent than in the former specimen, and there were some nodules of tartar on the roots of the teeth.

Lastly, the Society had acquired by purchase the skull of an African Manatee (*Manatus senegalensis*). The order *Syrenia* was thus beginning to be fairly represented in the Museum, for last session the skull of a female dugong (*Halicore dugong*) had been acquired and exhibited. The present specimen, the Senegal Manatee, differed from the



American variety in possessing forty molars, whilst the latter only had thirty-six. A curious difference in the vertebral column might also be observed, for while the axis and third cervical vertebra of the American variety were freely movable on each other, in the African species these two bones were firmly ankylosed together. Although the creature had forty molars; these were never all in position at one time, the anterior ones being developed and in use before the posterior; these latter being erupted later and moving forward, the front ones being in the meanwhile extruded: a somewhat similar arrangement to that observed in the case of the elephant's molars. In the premaxillary bone two temporary incisors were developed in the Manatee, but no trace of a tooth germ was to be found in the incisor region of the lower jaw, and no premolars were developed at all.

One peculiarity of the order Syrenia consisted in the bones of the ear being placed external to the skull instead of being enclosed in an auditory bone, peculiarities which were well marked in the present specimen and in the dugong lately acquired.

The following letter from Mr. Jas. Parkinson was then read by the SECRETARY:—

*“Sackville Street,*

*“November 1st, 1886.*

“DEAR MR. SECRETARY,

“It is with very great regret and disappointment to myself that I am by illness unable to be present this evening to introduce to the notice of the Society a portrait of our old and valued friend, Mr. T. A. Rogers.

“Several of his friends felt that they could not resist an opportunity given them to procure it for the Odontological Society, and they now offer it for your kind acceptance as a small token of the great regard they entertain towards him, and the value they attach to the great services rendered by him to the Society especially and the profession generally during the last thirty years.

“I feel that a convenient opportunity is also afforded me

of refreshing your memory with the numerous and varied services rendered by our old friend. You will find him at the first meeting of the Society, in November, 1856, one of your active and energetic Secretaries. This post he held until 1861, a period of great anxiety to those engaged in the formation and solicitous for the future success of the Society, and a large amount of the success attained was by his most useful and judicious co-operation. After this he continued a member of your Council, placing his experience and advice at its disposal. In 1865 he was unanimously elected President of the Society, an honour which was again accorded to him in 1881, and those who remember these periods will recollect how ably and generously he fulfilled the duties of this honourable position.

“The Odontological Society has not alone received the benefit of his valuable services. On the establishment of the Dental Hospital and School, offsprings of this Society, first in Soho Square and afterwards in this building, you will find him hard at work in assisting their development and afterwards becoming Dean of the School, a most important office. There must be many present in this room who can remember and appreciate his genial manner, his kind and sound advice, and his encouragement to all those seeking it. I could add much more in enumerating his services were it necessary, but these are so well known to the members of the profession that I refrain.

“Trusting that you will receive this addition to your walls with a hearty welcome,

“Believe me, sincerely yours,

“David Hepburn, Esq.”

“JAS. PARKINSON.

The Portrait, which, like those of Mr. J. Tomes and Mr. Parkinson, lately presented to the Society, is by Mr. Macartney, and a very satisfactory likeness, was then uncovered.

The PRESIDENT replied that it was unnecessary for him to say more than that he accepted the picture on behalf of the Society as a welcome addition to its collection. No one who had known Mr. Arnold Rogers could look at this portrait

without being reminded of his amiability and warm-heartedness, his dignity of character, and his constant desire to further the interests of the Society. In its name he thanked the donors most heartily for their valuable and acceptable present.

DR. ST. GEORGE ELLIOTT read the following letter from Dr. Taft, President of the Section of Dental and Oral Surgery of the International Medical Congress of 1887, and intimated that he should be glad to receive the names of any members of the profession who might be disposed to comply with Dr. Taft's request.

*"Cincinnati, Ohio, U.S.A.,*

*"October 7th, 1886.*

"MY DEAR SIR,

"We desire at the earliest possible moment to ascertain who will prepare papers and work for the Section on Dental and Oral Surgery of the International Medical Congress to be held next year.

"Will you give me the names of fifteen to twenty dentists in Great Britain and Ireland, who could and would be willing to prepare papers for the Section?

"Preparations are being made for a very extensive and complete presentation of clinical and prosthetic work. The aim is to arrange for ten to twelve operating chairs, which may be used by the best operators of each country, and thereby have all the various methods presented by the best skill in the world. Benches, lathes, furnaces, &c., will be furnished for the use of the best skill that can be found in Prosthetic Dentistry. Thus will be demonstrated all the various methods of constructing and inserting artificial substitutes.

"Facilities will also be made for various branches of scientific work, microscopical and histological, with illustrations of the most perfect kind. Operations upon and treatment of exposed pulps, diseased gums, and other soft tissues of the mouth will be performed by the best ability extant.



"Thus you see the plan is devised for large things. I trust that the meetings will be so arranged that sufficient time will be afforded for the profitable carrying out of this scheme.

"The clinics and practical work will be conducted in the best possible adapted rooms to be obtained in the vicinity of the hall in which the meetings of the Section will be held.

"This will give you an idea of the contemplated work of the Dental Section. Please give me your suggestions at your earliest convenience.

"Yours very truly,

"Dr. W. St. George Elliott."

"J. TAFT.

Dr. Elliott added that he would take that opportunity of making another announcement, which might be of interest to some of the younger members of the profession, and to those who were preparing to enter it. The only American dental degrees recognised in England, and therefore of value to English practitioners, were those of Harvard and Michigan Universities. Both of these bodies required all candidates to pass an examination in general knowledge, and it was found that this was sometimes an obstacle in the case of those who had devoted several years to the acquisition of professional knowledge. To obviate this the University of Michigan had determined to hold its preliminary examinations at various centres in this and other countries, so that students at a distance, who thought of trying for its dental degree, might have an opportunity of passing the examination in general knowledge before they entered upon their professional studies.

The PRESIDENT remarked that he hoped Dr. Taft's letter would meet with a ready response from members of the Society.

MR. STORER BENNETT exhibited on behalf of Mr. Colyer, one of the students of the Dental Hospital, a girl aged sixteen, and presented to the Museum models of her mouth which showed a very remarkable dentition. In the lower jaw were the two first permanent molars, the four milk molars, two

deciduous canines, and one peg-shaped temporary incisor. In the upper jaw there were only the roots of the deciduous canines and the right first permanent molar. The temporary centrals and the left first permanent molar had been extracted on account of caries some time previously, but no other teeth, as far as could be learnt, had ever been erupted.

The patient's history was of a very negative character, no abnormality having been noticed in the dentition of her parents, or of her brother or three sisters, all of whom were younger than herself. The girl's hair presented no peculiarity, and there was nothing in her personal history which tended to elucidate her condition.

MR. CHARLES TOMES showed a model of a remarkable case of arrest of development of the molar teeth, and also one of the teeth which he had extracted.

The patient, a man aged twenty-five, came to him complaining of pain in the right upper second molar. This was found to be due to an exposure of the pulp, the result of absorption caused by the pressure of the wisdom tooth. Mr. Tomes therefore extracted it and found to his surprise that it had no roots. Moreover, he ascertained by passing a probe beneath the crown of the first molar that it also had no roots. The crowns of both these teeth were fairly developed and at their proper level, but all the other six- and twelve-year molars ended level with the gum; the right upper molars had apparently been pushed up to the level of the other teeth by the eruption of the wisdom tooth on that side. From this Mr. Tomes was inclined to doubt whether any of these molars had roots. The remarkable fact in the case was that this arrest of development took place at the same stage of the growth of the teeth, but must have occurred at different periods in the life of the individual.

Mr. Tomes also showed a model of the mouth of a lady whose twelve-year molars were very small whilst the other molars were well developed.

Also a central incisor which had been handed to him for exhibition by Mr. Turner. It had been extracted on account

of looseness, and it was then found that the root had been entirely absorbed. The base of the tooth looked almost like that of a properly shed temporary tooth, but the margins of the cup-shaped depression were very regular and its surface remarkably even. No cause could be assigned for the absorption.

MR. R. H. WOODHOUSE pointed out that there was a filling on one side of the tooth, and suggested that this might have been the primary cause of the periosteal irritation of which the absorption was the result.

MR. J. F. COLYER showed models of a case very similar to that exhibited by Mr. Storer Bennett. The patient was a gentleman about thirty years of age, strongly built, of active habits, and who, except for indigestion, due probably to his deficiency of teeth, had enjoyed good health. Of the permanent set he had only the four six-year molars; there were also seven temporary molars, and two malformed incisors, one in each jaw. The temporary teeth were extracted and artificial dentures fitted. These he had now worn for some years, but no more teeth had made their appearance.

MR. S. J. HUTCHINSON laid before the Society some hints on various practical points which he hoped might be found useful.

From what he had seen during his visit to the United States in 1879, he thought that communications of this kind were more common in the American Dental Societies than they were in this country. He had himself derived benefit from some of the hints and contrivances which Dr. St. George Elliott had brought under their notice on several occasions, and he thought that Dr. Elliott's example might with advantage be more frequently followed than it had been hitherto. Possibly members might be diffident about bringing forward what seemed to them to be small things, but these small matters were often very useful in practice, and in fact this was the only excuse he could offer for his present communication.



All must at times have experienced the annoyance after mounting gum blocks of finding the joints come out black on the finished plate. In order to prevent this, some practitioners were in the habit of covering the joints inside and out with strips of No. 60 gold foil to keep out the rubber; but this did not always suffice. He had found that the easiest way of getting over the difficulty was to put the case into a thick paste of chloride of lime, and at the end of six or eight hours the black lines would be found to have been completely removed.

In pivoting teeth it was often convenient after preparing the root and taking a model, to send the patient away and complete the operation at a subsequent sitting. To be obliged to go about for a day or two with a gap in the front of the mouth was rather an unpleasant ordeal, especially for a lady, and in order to obviate this he found it a good plan to keep a few pivot teeth on hand,—some six or eight of various sizes and colours,—from which one roughly suited to the case could be selected and fixed temporarily but securely until the proper tooth is ready. Even a bad match was better, in the opinion of most patients, than the conspicuous disfigurement.

No doubt most of the members present had sometimes found it troublesome to match the incisors of elderly people when the teeth are dead or dull from the deposit of a thin layer of tartar. The plan commonly adopted in such cases was to rub the surface of the artificial tooth with sand-paper, but an easier way was to wipe over its surface with a little fluoric acid; this took off the gloss and left exactly the smooth dull surface required. Owing to its property of dissolving glass the acid must be kept in a gutta-percha bottle.

He often wished that he had five hands and no back, and probably others had been equally puzzled in trying to make two hands do the work of three, as for instance when one wants to use both hands in filling a cavity on the lingual surface of an incisor and to hold a mouth mirror at the same time. Under these circumstances the plan he adopted was to place a cork between the teeth, have a mouth mirror with a piece of wire attached, instead of the usual handle, and to

stick this into the cork. The latter acted as a gag, keeping the mouth open, and the mirror could be adjusted in any position and at any angle; it also served to keep the tongue down. He knew that some practitioners had a means of attaching the mouth mirror to the rubber dam clamp, but he thought his plan preferable on the whole, as being so very simple.

The PRESIDENT remarked that Mr. Hutchinson's communication was by no means the least valuable of the many he had heard in that room. He should certainly bear in mind his suggestion with reference to the mouth mirror. The suggestion with reference to pivoting was also a good one; it was very annoying to a lady to go away with a gap in her front teeth. But he would impress on those who might try it the importance of making these temporary pivots secure, for patients were not always to be depended on, and they might be served as he had been by a lady who, instead of making her appearance at the appointed time, did not come back for six weeks, and then only because she had swallowed her tooth at breakfast.

DR. ST. GEORGE ELLIOTT inquired how Mr. Hutchinson fixed his temporary pivot. A plan which he sometimes adopted as a temporary expedient, in order to ascertain whether a root would bear a pivot or not, was to take an ordinary plate tooth, attach to it with soft solder a German silver pin, insert this into the foramen, and pack amalgam round the head and against the back of the tooth. This could all be done in from fifteen to thirty minutes.

MR. F. J. BENNETT said he had found that the appearance of the black line spoken of by Mr. Hutchinson could be prevented by running a little thin osteo over the cracks between the blocks before packing the rubber. The plan suggested by Mr. Hutchinson seemed, however, to be a very simple and easy way of getting rid of it when it did make its appearance. He had found that when American teeth had been shaped, a black deposit, which it was very difficult to get off, was apt

to form on them during the process of firing. He thought that possibly the chloride of lime treatment might be found useful for getting rid of this also.

MR. HUTCHINSON replied that he used a hollow pin and floss silk, and took care to make the tooth secure. He had no fear of the patient not returning to have the operation completed; the effect of his temporary stop-gap was not good enough to satisfy a patient even for six weeks.

MR. WALTER COFFIN then described a process of facing hard rubber surfaces with metal recently invented and patented by Mr. M. G. Cunningham, and showed specimens of its results.

From the time when vulcanite was first introduced the advantages of such a process as Mr. Cunningham claimed to have perfected had been generally recognised, and many attempts had been made in this direction, but invariably failed, owing to the tendency of the gold to scale or strip from the rubber. Mr. Cunningham therefore made various experiments with the view of obtaining a more intimate mechanical admixture of the rubber and metal. He found that small particles of metal forced into the surface of the rubber and baked in could not be removed except by actual digging out, but he had still some difficulty in devising a means by which an equal and regular distribution of the divided metal in the substance of the rubber could be secured. The method finally adopted was as follows. All surplus rubber having been expelled and removed, the flask is closed with a fairly thick piece of calico or rag between the rubber and the model, then opened and the cloth taken away. The rubber is then painted with a special adhesive solution and the model treated with a preparation to secure a smooth surface. Finely sifted filings or a precipitate of the metal to be used being then spread upon the prepared surface of the rubber, and also upon the model, the flask is put together, closed and steamed in the usual way. After vulcanization the metalized rubber surface is finished with a smooth stone



and burnisher, and, if suitably prepared, may be plated, gilt or otherwise treated by electro deposition and the metal coating increased to any desired thickness.

Mr. Coffin added that his own experiments with this process showed that the coating obtained certainly adhered very firmly, and could not be detached without destroying the surface of the rubber; but it was not a continuous surface, at all events when filings were used, and he had not been successful in his attempts to plate upon this interrupted surface. By using a fine precipitate of gold he had obtained better results, but a large quantity of the precipitate must be used, and there was considerable loss. Still no other process yet introduced gave equally good results, and he thought it was worthy of further trial.

DR. WALKER said Mr. Cunningham had explained the process to him, and he had tried it in two cases. The first attempt was similar to Mr. Coffin's, but the second was more successful. It was sent to an electroplater and came back beautifully plated, but as it had only been worn five weeks he could not yet say anything about its durability.

MR. E. MOORE remarked that many attempts had been made to coat vulcanite with gold leaf, but it always wore off very quickly. The process just described seemed likely to give better results, but he should be glad to know what thickness of gold Mr. Cunningham considered necessary to stand the friction of the tongue, &c.

The PRESIDENT remarked that it was certainly a very ingenious process, but he was puzzled to understand how an interrupted surface of metal could be made continuous by the bridging over of the intervening spaces of non-conducting material.

MR. CUNNINGHAM replied that whatever the explanation might be, there was no doubt of the fact that the interrupted surface first obtained could be made continuous by electroplating, and he pointed out that Mr. Coffin's failure was due to his having omitted the preliminary step known amongst

platers as "quickenings," viz., dipping the article into a solution of nitrate of mercury.

MR. H. C. WALTER then showed and explained the action of Tauber's Hydraulic Press for swaging plates, which he claimed to be a great advance on all previous attempts in this direction. The demonstration, which was continued after the close of the meeting, was watched with great interest.

On the motion of the PRESIDENT, a vote of thanks was given to Messrs. Storer Bennett, Charles Tomes, Hutchinson, and other contributors of specimens and communications during the evening.

The Society then adjourned.

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# Odontological Society of Great Britain.

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## ORDINARY MONTHLY MEETING.

*December 6th, 1886.*

T. CHARTERS WHITE, M.R.C.S. & L.D.S.ENG.,

The following nominations are now under the consideration of the Council :—

FREDERICK ARTHUR CANTON, L.D.S.Eng., 34,  
Baker Street, Portman Square, W.

WILLIAM CASS GRAYSTON, L.D.S.I., 11, Valley  
Bridge Parade, Scarborough.

OSWALD FERGUS, L.D.S.Glasg., D.D.S.Univ. Penn-  
sylvania, 41, Elm Bank Street, Glasgow.

WALTER GLAISBY, L.D.S.I., 4, St. Leonards,  
York.

on this occasion he had allowed his friendship to run away with his usually calm and clear judgment. And at the same time I was struck with an amiable peculiarity of our profession in its treatment of those who have been so fortunate as to win its confidence. Not only does it confer on them all the honourable posts in its gift, but it continues to honour them still further for having accepted these distinctions.

“I beg very sincerely to thank those friends, whose names I presume I may not seek to know, who were so kind as to have the portrait painted, and to thank the Society through you, Sir, for allowing it a place among the portraits of those

who have worked for the advancement of our profession, all of whom it has been my privilege to know, and with most of whom I have been intimately connected by the ties of kinship or of the closest friendship."

The PRESIDENT said Mr. Rogers had spoken very modestly of his claims to their regard, but he thought the members would agree with him (Mr. White) in thinking that Mr. Rogers thoroughly deserved the compliment which had been paid him, and that, in fact, they could not have done less for one who had done so much for the profession, and who by his urbanity and kindness had endeared himself to all, from the oldest to the youngest. He had no need to say more, for the applause with which Mr. Rogers had been greeted sufficiently expressed their appreciation of him.

A letter from Mr. G. A. Ibbetson was then read by the Secretary, in which he returned his warmest thanks for the honour which the Society had conferred upon him in electing him an Honorary Member. As one of its founders he regarded with justifiable pride the high position which the Society had attained, and the signs of its continued progress. He felt assured that it was destined to rank with any of the scientific Societies of the metropolis, and that its honorary membership would be highly valued and eagerly sought after.

The PRESIDENT announced that the following gentlemen had been duly nominated as candidates for membership, and would be balloted for at a subsequent meeting, viz.:—

MESSRS. HENRY DAVIS, M.R.C.S., 157, Gower Street,  
W.C.

DANIEL BROWNING, L.D.S.Eng., 27, Upper Montague Street, W.

FRANK H. BRIGGS, L.D.S.Edin., 5, Park Crescent,  
Torquay.

WILLIAM EDWARD JAMES, L.D.S.I., Kingston-on-Thames.

Messrs. Walter Coffin and Newland Pedley were selected in the manner prescribed by the Bye-laws to audit the accounts of the Society for the past year.



MR. J. H. MUMMERY showed and presented to the Museum four models, together with the appliances used, illustrating the progress of a regulation case of a rather unusual kind.

The patient, a young lady aged fourteen, of very delicate constitution, had no molars in the upper jaw, these teeth having been extracted in consequence of severe and long-continued periostitis. There was great irregularity of the teeth anterior to the bicuspid, with very prominent canines, and the problem was how to act upon the bicuspid teeth in the absence of molars. This was, however, successfully accomplished in the course of about twelve months by the following means. A gold plate was made capping the first bicuspid and carried back along the alveolar ridge on either side and terminating in a hook to which was fastened a rubber ring. The ring was passed round the second bicuspid on either side and held down by a catch on the plate halfway between the tooth and the point of attachment of the rubber ring to procure a horizontal traction on the tooth.

The second bicuspid having been brought back it was capped and the same apparatus was brought to bear on the first bicuspid, from which the capping was removed. The reduction of the bicuspid having been effected, the other teeth were brought into position by a simple vulcanite plate with piano wire bands.

Mr. Mummery also exhibited an electric lamp for examination in the mouth, worked by a very neat and compact form of chromic acid battery supplied by Messrs. Meyer & Meltzer. It required to be recharged about every ten days, and this was very easily done, only one solution being used.

MR. W. HERN read notes of a case of diplopia and supra-orbital neuralgia caused by dental irritation.

The patient, a man aged fifty-six, was first seen by Mr. Lawson at the Ophthalmic Hospital, Moorfields, on July 23rd. He then complained of diplopia, which came on five days previously with the appearance of "clouds of smut" before both eyes. This was accompanied by severe localized pain about the left frontal eminence. Says he is not subject to sick

headaches. Tension is normal in both eyes, and vision is good. There was no movement of adjustment when either eye was alternately covered and uncovered. No history of syphilis.

Paralysis of the left superior oblique muscle was diagnosed, and he was ordered five grains of *Pil. Saponis Comp.* at night for the pain. Dental irritation was suspected, and a carious upper molar on the left side was seen. He was therefore advised to apply at the Dental Hospital of London for further treatment.

On August 3rd he presented himself at the Dental Hospital, bringing a note from Mr. Lawson mentioning the ophthalmic trouble, and requesting that a careful examination of the mouth might be made. This was accordingly done, and it was found that all the teeth were sound with the exception of the second left upper molar and wisdom tooth. The former presented a moderately large distal cavity at its neck which freely exposed the pulp; the latter presented a small mesial cavity which had not involved the pulp. A few of the teeth, both upper and lower, were affected with a slight amount of recession of the gum at their necks, but were not sensitive to cold or contact of instruments. The patient complained especially of the supra-orbital pain on the left side, which was so severe as to interfere with his rest.

The left upper second molar was extracted and the mesial cavity in the wisdom tooth filled with a gutta-percha stopping. A week later he reported that he was quite free from pain, but the diplopia continued.

On October 29th Mr. Hern received a note from Dr. W. J. Collins, Mr. Lawson's assistant at Moorfields, in which he said that the patient had continued quite free from pain, but still had diplopia on looking downwards.

Mr. Hern added that the case resembled in some respects one brought before the Society some months ago by Mr. Hutchinson. In both cases dental irritation caused both motor and sensory disturbance in the ophthalmic region, and in both the sensory trouble cleared off much more quickly than the motor. In the case just reported the diplopia was

now not nearly as bad as it was when the patient was first seen, and there was every probability that it would in course of time entirely disappear.

Mr. Hern also showed a mouth mirror with the glass fixed at an angle of about  $225^{\circ}$ , which he found very useful when filling buccal cavities. The ordinary mirror, with the glass attached to the handle at an angle of about  $135^{\circ}$ , was very inconvenient for such cases, since the handle came across the mouth and in the way of the work.

MR. S. J. HUTCHINSON said that he felt greatly interested in Mr. Hern's case. As that gentleman had pointed out, it corresponded very closely with one which he (Mr. Hutchinson) had brought before the Society not very long since.\* In that case irritation of the dental branch of the fifth nerve was reflected on to the third nerve in the orbit and set up spasm of the *levator palpebræ*, causing the condition known as lagophthalmus; in Mr. Hern's case the nerve affected by reflex action was the fourth, and the result was not spasm, but paralysis of the muscle supplied by it. In his case, as in Mr. Hern's, the neuralgia from which the patient had suffered disappeared at once on the extraction of the tooth which was the cause of the mischief; but the motor disturbance, the muscular spasm, cleared off very slowly, and did not entirely disappear for over six months. He had no doubt the result of Mr. Hern's case would ultimately prove equally satisfactory. He did not feel quite sure whether Mr. Hern was wise in putting a gutta-percha filling in the wisdom tooth. Was he quite sure that there was not some irritation going on from the pulp of that tooth? Certainly, if the motor trouble continued, he (Mr. Hutchinson) should advise its extraction. It would be remembered that in his own case he was induced to leave an amalgam filling, and that recovery did not take place until the tooth containing it was extracted, when a minute exposure of the pulp was found beneath the filling.

MR. NEWLAND PEDLEY remarked that all dental surgeons,

\* Trans., Vol. XVIII, p. 6.



and especially those holding hospital appointments, saw from time to time cases of eye lesions dependent on dental irritation, in which the removal of bad teeth or stumps effected a cure. At the same time such cases required strict investigation, and the relation of cause and effect must not be too readily attributed to every improvement following dental operations. A case which had recently come under his notice at Guy's Hospital illustrated this fact, and was not without its comic aspect. A young woman came amongst the dental out-patients complaining of very intense pain in her left eye, and stating that the sight of the organ was so much affected that she had lost all perception of light. The roots of the left upper first molar were removed, and when the patient returned a few days afterwards she said the pain had decreased. So far the case read like one of amaurosis dependent on dental irritation. But the patient was sent on to the ophthalmic surgeon, who came to the conclusion, after examination, that the loss of vision was imaginary, as was clearly proved by the fact that she read small print at a distance with a strong lens of short focus placed in front of the good eye—reading, that is, with the eye which she had declared blind. Obviously the improvement that followed the dental operation was imaginary.

MR. W. A. HUNT thought that all dental practitioners must be aware from constant experience that ophthalmic troubles did clear away after the extraction of bad teeth, and that they were not far wrong in attributing to the operation and the improvement the relation of cause and effect. He did not mean to say that it was common to meet with cases of actual organic disease of the eye as the result of dental irritation, but cases of functional derangement due to this cause were frequently met with; whilst the fact shown in the experiments of Von Hippel and Grünhagen, quoted by Mr. Power in his paper, that irritation of the fifth nerve would increase the intra-ocular pressure to the extent of several inches of mercury, was clear proof of the possibility of more serious mischief.

He should be glad to hear if any of the members had met with cases of paralysis of the seventh nerve depending on dental irritation. He had met with three such cases which were distinctly benefited by the removal of bad teeth. He thought that having regard to the close anatomical relations of the fifth and seventh nerves, some such influence might well be expected, though, so far as reported cases went, the seventh seemed to be much less liable to be affected in this way than its neighbours.

MR. F. J. BENNETT said he could not agree to the assertion just made by Mr. Hunt to the effect that it was the constant experience of dentists that lesions of the eye were cured by the removal of diseased teeth. In his experience such cases were rare, and he agreed with Mr. Pedley in thinking that cases of this sort should be submitted to the most careful investigation before assigning the relation of cause and effect to dental and ophthalmic lesions co-existing in the same individual. As an illustration of this, he would mention a case which occurred at the Dental Hospital some years ago, and which had been several times referred to at the Society's meetings. A girl applied at the hospital who had fractured her right upper central. The pulp was removed, and the root prepared for a pivot. In doing this an instrument passed up the canal probably passed through the apical foramen; certainly the patient complained of great pain. When she next attended she complained of pain in the eye of the same side, and was found to be suffering from iritis. She was sent to Mr. Lawson at the Middlesex Hospital for treatment, and that gentleman gave it as his opinion that there was no connection between the tooth and the eye inflammation, but that the occurrence of the latter at that time was accidental. The root was, however, extracted, and the patient ultimately got well. But in spite of Mr. Lawson's statement to the contrary, this case had been several times quoted at the Society's meetings as an example of reflex action. He (Mr. Bennett) thought that the opinion of a specialist who had had a large experience of eye diseases,

should be preferred to that of those who had no such knowledge or experience, and without wishing to throw any doubt on Mr. Hern's case, he did say that cases of eye disease caused by dental irritation, far from being common, were in his experience exceedingly rare, and that the case to which he had referred ought not properly to be considered one of them.

MR. S. J. HUTCHINSON thought that if those who had any doubts about the direct relationship between diseases of the eye and those of the teeth would study the paper on this subject read before the Society by Mr. Henry Power about two years ago, they could not fail to be convinced.

DR. WALKER remarked that he had been conversing with Mr. Power that afternoon on that very subject, and Mr. Power had told him many more cases of this character had come under his notice since he wrote the paper referred to. He spoke of having met with eight such cases recently.

MR. WALTER COFFIN said, with reference to the mouth mirror shown by Mr. Hern, that he had one in his possession which had been in use by his father for thirty years. It had glass on both sides, fixed at the same angle as that shown by Mr. Hern, and was designed for the same purpose.

MR. STORER BENNETT said he remembered seeing a mirror such as Mr. Coffin had described, with glass on both sides in use five or six years ago, but he could not then remember by whom it was used.

MR. HUNT said that by pure chance he had brought a very similar mirror with him to show at the meeting. It had a bayonet handle made of pure silver which could be bent to suit individual cases. With this he could hold the cheek away and obtain access to buccal cavities without any shadow.

MR. HERN replied that the cavity in the wisdom tooth was a small and shallow one on the front of the crown, not at all likely to give rise to any nerve irritation. The fact that the neuralgia had entirely disappeared showed, he thought, that there was no reflex disturbance going on at present. The



patient was seen and sent to him by an ophthalmic surgeon who would not have overlooked any other cause, and this placed the case on quite a different footing from that referred to by Mr. Bennett. Many undeniable cases had been reported by Sir Charles Watson, Messrs. Salter, Tomes, and others, in which strabismus and various other ophthalmic lesions had been cured by the extraction of carious teeth. Mr. Power's paper contained numerous cases of the same kind.

With reference to the mouth mirror, he thought that the fact that it had occurred independently to so many operators showed that it was worthy of notice.

MR. J. H. REDMAN related the following case of extensive alveolar abscess and its consequences:—

A girl aged twenty-two came to him with a large abscess about the angle of the jaw. It had opened externally, and there was abundant discharge, together with considerable swelling and induration of the tissues. With some difficulty he forced open the mouth and found that the source of the mischief was an impacted lower wisdom tooth, but in order to reach this he was obliged first to extract the second molar. He was then enabled to extract the wisdom tooth. The abscess soon closed and the swelling subsided, but the patient began to complain of very severe neuralgia affecting that part of the face. Mr. Redman removed the roots of the first molar as being a possible source of irritation; but this did no good, and he had come to the conclusion that the pain was due to the implication of some nerve branch in the cicatrix. This was firmly adherent to the jaw, and he had no doubt that it pressed upon some branch of the seventh nerve just where it crossed the bone. He had suggested to the medical man in charge of the case that he should cut down and free the cicatrix, but up to the present his suggestion had not been acted upon.

Mr. Redman also showed a curiously deformed deciduous central.

MR. HUNT showed a model of the lower jaw of a lady in which the whole of the alveolar border in the molar and bicuspid region on both sides had been absorbed as the result of pressure.

All practitioners were familiar with the fact that cotton wool packed between the teeth would separate them. He had a remarkable example of the extent to which this separation might be carried in the case of a lady who came to him some time back with cavities in the contiguous surfaces of two lower molars. As the teeth could not be preserved, and the patient would not consent to have them extracted at the time, Mr. Hunt advised her to put a small piece of cotton wool moistened with eau de Cologne into the cavities daily, and to come again on the first convenient opportunity. She did not return for twelve months, and then, to Mr. Hunt's astonishment, instead of the small space previously existing between the teeth, there was an interval in which he could place his thumb caused by the constant packing of plugs of cotton wool into the space.

The case illustrated by the model was another example of the mischief that might arise from this cause. The patient was a lady, aged forty, who had worn for some time a complete upper and partial lower plate. The latter, which carried all except the six front teeth, beginning to pain her, the patient put some cotton wool under it to ease the pressure, and continued the practice, gradually increasing the amount of wool, until the state of things shown by the model was the result.

The PRESIDENT said he had no doubt most of those present had met with cases more or less resembling those described by Mr. Hunt. He himself had seen very similar results produced by the injudicious use of the plastic gutta-percha sold in the shops for stopping purposes. One patient produced a hole in the alveolar process by adding this to the under surface of a lower frame. And quite recently a lady came to him with a space between the upper centrals, equal in breadth to one of them, and caused by gutta-percha used in the same way as the cotton wool had been by Mr. Hunt's patient. The gap was so unsightly that Mr. White was obliged to close it with a supplementary tooth.

MR. WILLOUGHBY WEISS said the case just mentioned by

the President reminded him of one very similar which had occurred in his own practice. A patient who came to consult him about some other matter, remarked that he could not make out what had become of a tooth in the lower jaw, for he was sure it had not been extracted. On examination Mr. Weiss found a space between the bicuspid large enough to accommodate another tooth, and on questioning the patient it became evident that this had been caused by packing gutta-percha between the teeth, with the view of stopping a small cavity in one of them.

DR. GEORGE CUNNINGHAM exhibited the model of a most ingeniously constructed appliance, which had been devised by M. Rosenthal, of Liège, for a patient who had lost a considerable portion of the lower jaw.

The operation, which was performed by Professor von Winivarther, of Liège, was necessitated by a sarcomatous tumour, the parts removed consisting of the body of the lower jaw posterior to the second bicuspid, together with the ascending ramus and condyle. As the result of unopposed muscular action, the other condyle became dislocated, and the patient was quite unable to make any use of the part of the jaw which was left.

Two months after the operation M. Rosenthal's assistance was sought; models were taken and an apparatus made with the view of restoring the parts to their proper position. As it was found impossible to reduce the dislocation without the aid of an anæsthetic, chloroform was administered by Professor von Winivarther, and Dr. Traipont, the house surgeon, holding the jaw in place, the apparatus was inserted in the mouth and secured.

The apparatus consisted of two parts. A lower plate, or rather double collar, encircling the two lower bicuspid, firmly fixed in position by a screw bearing on the mesio-labial aspect of the first bicuspid. To the extremity of this plate was soldered a long tube, for the reception of a strong pin attached to the centre of a small partial gold upper plate, furnished with two clasps, the anterior embracing the upper second bicuspid, the posterior encircling the remaining upper molar. The upper



plate was attached to the teeth by two screws. The length of the pin was such that it could not slip out of the retaining tube, even when the mouth was opened to the greatest extent. By this means the patient obtained a simple up and down or hinge-like movement, but of course any lateral or backward and forward motion was impossible.

In order to test the appliance, M. Rosenthal made the patient eat before she left the couch, and she said she could do so without any inconvenience whatever.

Some months afterwards he wrote to her asking how the apparatus was answering its purpose; she replied that it answered well, and that she was able to eat without difficulty.

The evils to be feared were, first, the possibility of injury to the teeth from friction of the clasps; this was guarded against by securing it firmly by means of screws. Secondly, injury to the teeth from food collecting about the appliance. This was inevitable, since the appliance could not be taken out for cleaning and replaced, owing to the tendency to dislocation of the jaw. But M. Rosenthal believed that with a person of cleanly habits, as this patient was, a fixed apparatus made in gold would last ten or twelve years without damaging the teeth supporting it.

M. Rosenthal's latest report was that he had seen the patient, who was enjoying excellent health. The gums were pink and healthy; the teeth maintained the apparatus securely, and were as firm as the others. The apparatus had been in use nine months. From the time of the operation until the appliance was fitted the patient could take nothing but liquids, with it she could eat solid food without difficulty, so there could be no doubt about its success, but Dr. Cunningham thought that it would have been wiser to have distributed the strain over more than two teeth in each jaw, and he had also suggested that it would tend to the preservation of the teeth if they were completely encapsuled by the plates, which might be secured with pyrophosphate cement.

MR. STORER BENNETT said that some five or six years ago he was consulted by Mr. Lawson with reference to a patient

on whom he had performed Esmarch's operation for the relief of closure of the jaws. She had suffered from this for a long time; it was said to be the result of cancrum oris, but the history of the case was not quite clear. The jaws had been twice opened by means of wedges, &c., but closed again as soon as treatment was discontinued. Then some necrosis took place, with offensive discharge into the mouth, and finally Mr. Lawson removed a wedge-shaped piece from the front of the jaw. The object now was to keep the halves of the jaw apart, so as to maintain proper articulation with the upper teeth, and yet to allow a certain amount of independent movement. For this purpose Mr. Bennett made a small gold plate with bands grasping the left first lower bicuspid with a gold tube attached by means of a hinge joint. A similar plate was fitted to the right lower canine with a pin hinged to it which worked in the tube. He had the patient under observation for about three years, and during that time the apparatus worked very satisfactorily, but for some time past he had lost sight of her.

In answer to a suggestion from the President, Mr. Bennett promised to show the apparatus at the next meeting, and to show the patient also if he could trace her.

MR. HENRI WEISS said he had been consulted with regard to a patient who had had a portion of the lower jaw removed on account of malignant disease, with the result that the lower teeth were displaced laterally about three-quarters of an inch. As the man was in bad health, and it was thought desirable to disturb the parts as little as possible, he simply fitted an upper case with a vulcanite block against which the lower teeth bit, and this answered its purpose sufficiently well. A recurrence of the disease took place soon afterwards and eventually proved fatal.

MR. E. LLOYD WILLIAMS wished to point out that the model of the apparatus now shown by Dr. Cunningham did not reproduce the natural articulation, and must therefore be necessarily faulty. Dr. Cunningham's plaster models were articulated by a broad iron hinge placed at the back giving

the apparatus a motion which it could not possibly have in the mouth. The artificial joint shown was mechanically incorrect, and unless the rod attached to the upper plate was extremely loose in its socket no movement whatever could take place. He suggested that the base plates should be considerably enlarged, so as to give an increased area over which to distribute the pressure; to these should be attached two rods, one to the upper and one to the lower plate, secured by a simple pin joint, a similar joint bringing the free ends together. In this way a good joint would be obtained, mechanically correct and likely to prove useful.

DR. CUNNINGHAM, in reply, admitted that neither his diagram nor his model were in all respects strictly accurate, and with regard to the apparatus itself he thought it would have been better to distribute the strain, which must be considerable, over a larger area. It had, however, proved itself a practical success, and its great merit, in his opinion, was its simplicity.

MR. R. H. WOODHOUSE showed for Mr. Reboul a model of the upper jaw of a child aged five years and nine months, with a supernumerary lateral incisor. It had been sent for the Museum.

The PRESIDENT said he much regretted that Mr. Wm. Cunnington, who was to have exhibited some very interesting prehistoric jawbones that evening, was unable to be present owing to indisposition; but he had very kindly sent the specimens, some twenty in number, together with a letter giving an account of the circumstances under which they were found, and he (the President) would supplement this with a few remarks on mound burials in general, as well as on the particular specimens submitted for examination.

The custom of erecting mounds or "barrows" over the resting place of the dead might be considered a practice of almost universal adoption, having been met with in almost all parts of the world. The term "barrow" came from the Anglo-Saxon word *beorh*, signifying in this case "a grave



mound." They were of two kinds, cairns or mounds of stone, and barrows or mounds of earth. These latter varied in size from a few feet to that of a miniature mountain. They differed in shape also as well as in size, some being round, while others were oval or pyriform. The long form, of which that from which these specimens were taken was an example, was considered by archæologists to be the older of the two, and probably confined to the neolithic age, before any metal was in general use in ancient Britain. This opinion was based upon the fact that no weapons or implements of metal of any kind have ever been found in these "long" barrows, though weapons of bone and stone, and especially leaf-shaped arrow-heads of flint, are occasionally met with. The pottery, also, used by these people was of the rudest kind, and quite devoid of ornament. It was probable, therefore, that these mounds contain the relics of the earliest inhabitants of Britain of whom any sepulchral monuments exist.

It seemed to have been a common practice in those ages when a chief died to slaughter wives, children, and dependents; hence a number of skeletons were found interred beneath these mounds. Burning the bodies did not appear to have been introduced till the "bronze" age, the period immediately following the stone age, and so the skeletons of this barrow were in a tolerably fair condition of preservation, due perhaps as much to the greater density of the bone, as to the dry entombment to which they had been subjected beneath heaped-up chalk and dry turf or humus.

The body of the individual in whose honour the barrow was raised was always found at the deepest part of the mound, whilst the humbler portion of the community were buried at no great depth beneath the surface. From this it might be concluded that these tumuli were erected over the remains of chiefs of clans, or persons in some considerable authority; this fact being emphasized by one barrow containing but the body of a child, presumably the future head of the clan.

Often with these human bones were found those of animals, and it had been supposed that these were the remains of

funeral feasts partaken of by the survivors over the interment, and buried with the bodies of the slain. There appeared to be some evidence, also, that these early inhabitants, if not anthropophagi, were given to eat their animal food in an uncooked condition.

When these places of sepulture were very carefully examined, the body which formed the principal interment would be found placed upon the side with the knees drawn up, in the position in which many people go to sleep. So constantly was this the case that out of 301 burials of unburnt bodies, only four instances occurred in which the body was laid out at full length.

There was one very striking fact in connection with the two kinds of barrows usually met with, and that was that whilst the round barrows were found to contain both brachycephalic and dolichocephalic skulls, the crania found in the long barrows were invariably dolichocephalic or hyperdolichocephalic. The skull exhibited that evening was a very good example of the latter type.

But it was particularly with the jaws they had to do that evening, and in introducing that subject he would point to one or two facts noted by previous observers. Mr. Mummery found sixty-eight skulls of the long barrow period in Wiltshire, and amongst them only two cases of dental caries, whilst in thirty-two skulls of the round barrow period he found seven cases of caries. Of sixty dolichocephalic skulls from Yorkshire tumuli no less than twenty-four exhibited the disease. Professor Rolleston, in his examination of an entire series of bones, fragmentary as well as perfect, found the amount of caries much the same as Mr. Mummery did in the Wiltshire burials of the same period. Ten lower jaws, nine of which were from persons beyond the age of puberty, were recovered from a long chambered barrow, and Professor Rolleston says, "In none of these lower jaws had any teeth been lost before death; in only one is there any caries visible; and in one other, an old woman, there is a cavity formed by an alveolar abscess in connection with a first lower molar worn down to the fangs, with its pulp cavity obliterated by secondary

dentine." It was a curious fact in connection with this last case that the women of the stone age seemed to have been strongly predisposed to alveolar abscess, being found more frequently the subjects of it than the men. This had been attributed by anthropologists to their having lived under more anti-hygienic conditions, being more confined to their unhealthy huts than the men, who are supposed to have been out hunting for food or fighting their enemies. Amongst the maxillæ on the table there was one showing signs of the existence of an alveolar abscess.

There was also a portion of the lower jaw of a child, probably five years of age, in the collection, with the right lower canine and first and second molars unerupted and *in situ*. This tended to strengthen the supposition of a sacrificial slaughter having preceded the formation of this tumulus, as a child of this tender age would hardly be found fighting with warriors, and slain in battle. The skulls found with these jaws had, with few exceptions, been cleft through or near to the sagittal suture with a tolerably clean cut while the bone was yet soft, as during life, the inner table of the cranium being splayed out by the force of the blow. A portion of a left upper maxilla was cleft in a similar manner, the incision going longitudinally through the lateral incisor. This cut was manifestly given either during life or immediately after death, while the bone was moist, for the edges of the cut were as clean as if done with a knife.

He would call their attention to the condition of the molar teeth in these jaws, to the extraordinary way in which their grinding surfaces had been worn. This had always been stated to be due to the rough method of grinding the corn\* between two gritty stones practised in those primeval ages, and he presented some evidence in confirmation of this under the microscopes on the table. It had occurred to him that as particles of food became imprisoned in the tartar, sealed up in an insoluble concrete of lime, and could be made to reveal themselves upon the solution of this material,

\* See Trans., Vol. XVI, N.S., p. 213.



it would be an interesting revelation if the tartar found on these teeth of the stone age could be made to give up its secrets in a similar manner. He accordingly carefully decalcified some small portions, and examined the sediment. The result of this examination he had embodied in the list before them. The sediment consisted of pale drab-coloured pulpy amorphous masses, apparently composed for the most part of altered and disintegrated epithelial scales mixed with the contents of starch cells. Throughout these masses were scattered grains of sand in great abundance; polarized light discriminated between these grains and showed them to be of two kinds, some being composed of silex, and the others of quartz or granite. Mr. Cunningham informed him that he had found in a Wiltshire tumulus a quern, as it was termed, in which the corn was ground, probably by the aid of a round hard flint. This quern was of greensand, very soft and friable; and if the querns generally were of this nature it would fully account for the abundance of these sandy particles in the tartar, and also for the way in which the masticating surface of the molars had been eroded. In addition to the above, and more sparsely scattered through the sediment, he was enabled to identify the barblets of feathers, husks of starch corpuscles, portions of altered husk of corn, and of wool; a spiral vessel from vegetable tissue, a diatom or polycystine—he could not say which, but he had had suspicions of polycystine fragments from other portions of the sediment; some oval, violet-coloured bodies; the point of a fish's tooth. There were also two organisms which he had failed to recognise, and should be glad if any of those present could enable him to do so.

As the interesting collection deserved a careful examination he would not detain them longer, but would just read the following description by Mr. Wm. Cunningham of the circumstances under which the specimens were obtained:—

“The ancient human teeth which I have the pleasure of exhibiting this evening to the members of the Odontological Society were obtained by me in June last from a ‘long’ barrow called ‘Bowlbury,’ or ‘Bowl’s barrow,’ near Heytes-

bury, in South Wilts. It is well known to antiquaries, having been opened by Mr. Cunnington, F.S.A., in 1801, and described in Hoar's 'Ancient Wilts' (I, 87), and again by the late Dr. Thurnam in 1864. It is 150 feet in length, by about 50 feet in breadth, and nearly 11 feet high. It is bounded on the sides by two ditches, which, as is characteristic of long barrows, do not extend round the ends; from these ditches the chalk, of which the mound is chiefly constructed, was obtained. Extending along the centre, at the base of this huge tumulus, is a heap of large flints and sarsen stones, piled up in a long ridge 5 feet high, described by Mr. Cunnington as 'resembling the roof of a house.' Beneath this ridge, towards the eastern and highest end of the barrow, the human bones were found. They cannot be described as skeletons, for they were interred in great disorder, thrown together promiscuously. In one instance, for example, a mandible was found with the left condyle passed through the opening of a vertebra dentata. More than half the crania had been cleft or violently fractured. Many persons were interred in this barrow. Dr. Thurnam obtained six crania, and on the late occasion I found the skulls, or portions of skulls, of fourteen or more individuals."

MR. HEPBURN showed some specimens obtained by one of his patients from a small island off the west coast of Ireland. At low tide this island could be reached by wading, and its surface was found to be strewn with human bones. Amongst those now shown was the lower jaw of a child about eleven years of age, and another of a child of eight. There were also several adult jaws and one of an old person. There were no means of judging as to the age of these specimens, and the people of the neighbourhood could give no information respecting them; but they resembled those shown by Mr. Cunnington as regards the splendid quality of the teeth, which, though in some cases much worn down by use, presented no trace of decay.

The PRESIDENT then proposed that the thanks of the Society be given to Messrs. Mummery, Hern, Redman, Hunt,

Cunningham, and others for their communications, and to Mr. Cunnington for the loan of his interesting specimens.

This having been carried by acclamation, Mr. White announced that the Annual Meeting of the Society, for the reception of financial and other reports, election of officers, &c., would be held on January 10th, and closed the meeting.



# Odontological Society of Great Britain.

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## ANNUAL GENERAL MEETING.

*January 10th, 1887.*

T. CHARTERS WHITE, M.R.C.S. & L.D.S.ENG.,

PRESIDENT, IN THE CHAIR.

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THE Minutes of the previous meeting having been read and

The following nomination has been received by the Council:—

FRANK H. KISSACK, L.D.S.Eng., 17,  
Bentinck Street, Manchester Square, W.

of officers, and MESSRS. E. DUNN and  
chosen to act as Scrutineers.

The PRESIDENT then called upon the Librarian for his Annual Report.

MR. WEISS said he was happy to be able to report that the Library was in a satisfactory state. The number of new books added during the year was not large, since but few new works had been published of late, and the library being nearly complete there were not many old books of which they did not already possess copies, but if any of the members should come across any old books on dentistry which were not to be found in the library, he should be glad to purchase them. He was very pleased, also, to be able to state that there was an increase in the number of books borrowed, and for the first time more members than students had made use

of the library, viz., sixty-one members, and fifty students; in previous years the number of students had exceeded that of the members.

Two books were missing—the sixth volume of “Todd’s Anatomy” and “Quain’s Anatomy.” The latter was a very old edition, and perhaps the borrower thought that if he did not return it a newer copy might be presented.

The Treasurer’s Report was presented by Mr. Hepburn, who read the following letter from Mr. Parkinson:—

36, Sackville Street,  
January 10th, 1887.

MY DEAR MR. PRESIDENT,

I am still a prisoner after dusk, so forward you an account of all I know concerning the Society.

You will find our receipts for the past year are about the same as last year.

Our expenditure under the head of Sundries includes the cost of our *Conversazione* at the Medical Society’s Rooms in August last. This has diminished any surplus we might have had to £20 8s. 1d.

These expenses were kept as low as possible by the able management of our Secretaries, to whom many thanks are due.

I have not as yet been able to get at our exact number of members at present, but will do so in time for publication, as also the members we have been obliged to remove from our Society for non-payment of subscriptions; these subscriptions are three years in arrear, including the present session, and are more numerous than we could wish.

I am sorry not to be with you this evening, but hope in the course of another month to be in a state to get about of an evening again.

Will you kindly ask our Secretary to make the enclosed statement to the Society for me? and oblige,

Yours very sincerely,

JAS. PARKINSON.

T. CHARTERS WHITE, ESQ., *President*.

*Treasurer in Account with THE ODONTOLOGICAL SOCIETY OF GREAT BRITAIN,  
for the Session ending 31st October, 1886.*

Dr.	£ s. d.			Cr.	£ s. d.		
To Annual Subscriptions ..	..	..	399 0 0	By Printing and Publishing Transactions..	..	..	96 2 8
Entrance Fees ..	..	..	28 7 0	Postage of ditto ..	..	..	13 7 1
Arrears of Subscriptions	..	..	25 4 0	Sundry Printing ..	..	..	28 14 0
Sale of Transactions ..	..	..	14 17 0	“Woodbury” Portraits..	..	..	9 17 3
Ditto ..	..	..	0 17 6	Reporting ..	..	..	20 0 0
Interest on Stock ..	..	..	40 16 6	Rent (one year) ..	..	..	105 0 0
Interest on £550..	..	..	17 17 6	Refreshments ..	..	..	22 17 0
Interest on Deposit Account ..	..	..	1 19 0	Library ..	..	..	16 1 8
				Museum ..	..	..	27 12 2
				Interest on Stock invested	..	..	40 16 6
				Postage ..	..	..	8 17 8
				Sundries ..	..	..	119 4 5
				Surplus ..	..	..	20 8 1
			<u>£528 18 6</u>				<u>£528 18 6</u>

F. NEWLAND PEDLEY, }  
WALTER H. COFFIN, } *Auditors.*

JAMES PARKINSON, *Hon. Treasurer.*



*Assets of the Society, 31st October, 1886.*

	£	s.	d.
Stock, New Three Per Cents .. .. .	1,417	16	7
Cash at interest .. .. .	550	0	0
Cash at Bank, on deposit and in Treasurer's hands (31st October, 1885) .. .. .	£652	9	7
Surplus .. .. .	20	8	1
	<hr/>		
	672	17	8
	<hr/>		
	£2,640	14	3

JAMES PARKINSON, *Hon. Treasurer.*

F. NEWLAND PEDLEY,	} <i>Auditors.</i>
WALTER H. COFFIN,	

New Members elected (1885-86)—	Total
Resident .. .. .	5 } 15
Non-Resident .. .. .	9 }
Honorary .. .. .	1 }
Resignations—	
Resident .. .. .	3 } 4
Non-Resident .. .. .	1 }
Deaths—	
Resident .. .. .	0 } 6
Non-Resident .. .. .	6 }
Removals for non-payment of Subscriptions .. .. .	9
Number of Members .. .. .	295
Honorary and Corresponding ditto .. .. .	34

The CURATOR (MR. STORER BENNETT) reported that during the year 41 specimens had been acquired for the Museum. As they had all been acknowledged at the time of their donation it was needless further to allude to them.

Certain alterations in the arrangement of the Comparative Anatomy specimens had been commenced, by which it was hoped the collection would be rendered more easy of examination, and therefore of greater value for purposes of study.

A series of preparations was also in course of formation, which when completed would afford valuable information concerning the sockets and roots of teeth in various animals, and had already led to the discovery of some interesting features in the preparations examined, to which he hoped to allude on a subsequent occasion.

In conclusion, he cordially invited contributions of interesting specimens, whether any of a similar character appeared in the catalogue or not, duplicates being always valuable for

comparison, &c.; and if specimens, especially human ones, were accompanied by a short history, their value would be greatly enhanced.

Many skulls illustrating the dentition of the lower animals were still absent from the collection, and would be extremely welcome additions; among others he might mention were those of the lion, wolf, bull-dog, King Charles spanniel, toy terrier, greyhound, pole-cat, weasel, racoon, ant-eater, sloth, beaver; common, horseshoe, and vampire bats; and duck-billed platybus."

DR. WALKER then read the following Casual Communication:—

"MR. President,—Since the discussion on Mr. Cunningham's method of coating vulcanite dentures with pure gold I have prepared four dentures for four patients whose mucous membrane was very much congested, and the epithelium of the slightest character. I have seen each of these patients since introducing the dentures, and one and all inform me no heat has been generated in wearing the dentures, and on examination after a month's wear I can detect no line of congestion at the edges of the dentures.

"The object of depositing gold on vulcanite is to avoid congestion arising at the necks of teeth, and so prevent as much as possible the teeth becoming denuded of the gum and periosteum.

"On examining these dentures after a month's wear I found no disposition of the gold to peel; in fact, the dentures appeared as if they had only just been introduced.

"I have brought you nine specimens to illustrate the process,—attached to each specimen are written particulars,—and I have also brought a Bunsen's battery to show the members the size and strength of battery that I find most successful.

"Although it is possible, as stated by Mr. Cunningham, to obtain a continuous surface of gold by direct deposition on the filings, this is facilitated by coating the surface of the plate with plumbago before submitting it to the action of the

battery. The deposition of gold is also accelerated if the surface of the denture is first coated by means of the battery with a thin film of silver or copper, as seen in some of the specimens exhibited.

“These specimens have been prepared in my own work-room under the supervision of Mr. Cunningham, to whom I feel much indebted for an immense stride of advance in vulcanite work.

“If there is any member present who would like to see the action of the battery, I shall be pleased to remain after the meeting for the purpose of putting it in action.”

Dr. Walker then handed round the following specimens:—

- No. 1. Black vulcanite denture, coated with pink. Anchorage of gold filings; film of gold and copper deposited by Bunsen's battery, without plumbago.
- No. 2. Black vulcanite denture. Anchorage of gold filings; surface burnished with plumbago.
- No. 3. Black rubber denture. Anchorage of gold filings; surface of model powdered with plumbago before vulcanizing. After vulcanizing, pure gold deposited by Bunsen's battery.
- No. 4. Ash's brown rubber denture. Anchorage of gold filings; a film of pure silver deposited by Bunsen's battery; pure gold deposited by Bunsen's battery.
- No. 5. Black rubber denture. Teeth mounted with gold tongues. Anchorage of gold filings; model powdered with plumbago before vulcanizing; film of silver deposited by Bunsen's battery; gold deposited by Bunsen's battery.
- No. 6. Teeth set up, packed with Ash's pink rubber, and sprinkled with gold filings on female matrix.
- No. 7. Upper model sprinkled with gold filings.
- No. 8. Teeth set up, packed with black rubber; gold filings sprinkled on female matrix.
- No. 9. Model powdered with plumbago, and burnished ready for coat of gold filings.



The PRESIDENT thanked Dr. Walker for the trouble he had taken in preparing the specimens and exhibiting them. A great deal had been said from time to time about the poisonous effects of vulcanite, but, as he believed, with very little foundation of fact. The bad state of the mouth sometimes met with in patients wearing dentures was due, he thought, not to the plates themselves, but to the carelessness and want of cleanliness of the patients. Still this ingenious process of gilding would prevent all possibility of the alleged poisonous effects, and would serve to relieve the fears and remove the prejudices of a certain class of patients.

MR. MOORE thought that the point to be first discussed was whether pure rubber could produce any prejudicial effect in the mouth.

MR. VANDERPANT (Kingston) inquired whether the addition of the deposit of gold at all affected the power of suction? and also whether, if gilding one surface of the denture was an improvement, it would not be a greater gain to gild both?

MR. STOCKEN remarked that vulcanite dentures were not the only ones which were liable to cause an unhealthy condition of mouth in certain individuals. Some years ago he made a denture of the best quality of dental alloy for a lady patient. After wearing it a short time she came complaining of the state of her mouth, and on examination he found the mucous membrane covered by the plate studded with minute ulcers; it should be stated that the plate was an excellent fit. Mr. Stocken then made the patient a set in vulcanite, and the soreness at once disappeared and did not recur. The patient informed him that a small plate made of dental alloy which had been made for her some years previously, had produced precisely similar effects.

MR. REDMAN said he had occasionally met with cases in which bad effects had been produced by the wearing of rubber dentures, but the evil was not due to any poison in the rubber, but simply to the fact that it was a bad conductor of heat. He instanced the case of a lady for whom he made a denture

in red rubber; after some weeks ulceration of the mucous membrane over the palate appeared, and resisted all sorts of treatment. At last he substituted a gold plate for the vulcanite, and the ulceration was soon cured.

MR. HENRI WEISS remarked that in some cases where there was extreme tenderness of the gums, but without actual ulceration, he had effected a cure by lining that part of the plate with gutta-percha.

DR. WALKER replied that the plate could be coated on both sides if thought desirable, but of course this added to the weight, and there was nothing gained by it; all that was really necessary was to coat the surface which was in contact with the mucous membrane. There could be no doubt that the explanation given by Mr. Redman of the cause of the bad effects of rubber plates was the correct one. Many patients only inserted their dentures when actually required for use because, as they said, they were so much cooler without them. Gold did not produce the same result because it was a much better conductor of heat. He had, of course, met with many cases similar to that related by Mr. Redman. One patient who had worn a black rubber denture for three months only came to him with no less than five ulcers which had obstinately resisted surgical treatment. A gold plate was made and fitted, and the ulcers were at once and permanently cured.

DR. ST. GEORGE ELLIOTT said the Society had done a great deal of good scientific work, but he was not quite sure whether the practical work of the profession had always received a due share of attention. One of the avowed objects of the Society was to cultivate social intercourse amongst its members. Now there was nothing which would combine the Social and Practical so well as a clinic. Proposals for the holding of clinics had been made by members of the Society, but, no doubt for good and sufficient reasons, the Council had not favoured them. He suggested, therefore, that the members individually should take up the matter. He wished to say that he should be glad to see any of the

members at his house at 5 P.M. on the following day, when M. Rosenthal, of Liège, would exhibit a contrivance of his own for washing out the sac of an alveolar abscess. And further, that he should be glad to welcome any of the members who would come on Monday, February 7th, the day of the next meeting of the Society, at 2 P.M., when he hoped to have two chairs occupied, and something worth seeing shown in each of them. He hoped to be able to make similar arrangements for the subsequent (March) meeting, but of this he would give further notice.

MR. S. J. HUTCHINSON called attention to the following simple method of correcting an otherwise incurable irregularity :—

A lady, aged twenty-five, came to him with an upper lateral much misplaced. She had worn five plates, but without any good result, and on examination Mr. Hutchinson found that this was owing to the faulty direction of the root. He therefore fitted a gold collar round the tooth, secured it with “osteocement,” and soldered an artificial lateral to this in its proper position. It might perhaps be asserted that the collar would work loose, and that the lateral would decay, but he did not think that with ordinary care and cleanliness this would occur. Of course the work should be inspected from time to time and the osteo lining renewed when necessary.

The PRESIDENT remarked on the ingenuity of the arrangement.

MR. MORTON SMALE then read the following communication on the subject of Cocaine :—

“Mr. President and Gentlemen,—I feel a certain hesitation about introducing the subject of Cocaine before you to-night, and would not venture to do so, did I not think that the subject was one fraught with much importance to our profession. The profession, as a whole, are in a condition of suspended judgment on the matter, and it is time all suspense was removed.

“The best way, it appears to me, to bring about so desirable



a result, is, that some authoritative utterance should go forth from this Society as to the value and use of the drug. As a Society we owe this to our profession. Surely no better service can be rendered the members of it, and of the profession at large, than to investigate scientifically and put forth the result of our experience as an authoritative declaration on any discovery or new method of practice that may be introduced.

“It appears to be good when committees are formed for such purposes. One consisting of careful investigators might with advantage be formed for this purpose. Cocaine is before the public, and it behoves us to be ready, with no uncertain voice, to express an opinion upon it.

“Messrs. Hunt, Wallis, Brunton, and others have already done more than enough to prove there is ‘something in it’ in relation to dentistry. We owe the former of these gentlemen a great debt of gratitude for introducing the injection of cocaine into the gum tissues. I began using it (cocaine) in 1884, and since then have never been without it. In the Westminster Hospital Report for 1885, published early in 1886, I thus speak of it:—

“‘Its main uses are as follows:—

“‘In extraction, if the drug is applied to the gums surrounding the tooth (the part having first been dried and protected from the saliva, or the cocaine will be washed away), the pain attending the adjustment of the forceps is obviated, but the wrench attending the fracture of the outer wall of the alveolus and rupture of vessels and nerves at the apical foramen is much the same. A small loose stump may be removed almost painlessly.

“‘In cases of fractured teeth, where it is necessary to remove the pulp, cocaine is also useful. Applied to the surface of the exposed pulp, it will deaden the sensibility, and if applied several times at short intervals the nerve-extractor can be passed up the tooth, and the pulp extracted at once with very little pain. Cocaine is more effectual than anything else in these cases.

“‘In cases of odontalgia, when the pain is due to exposed pulp, caused by caries, it is not better than carbolic acid.

“‘In cases of periodontitis, when the tooth is painful on percussion, and feels too long, it is useless; counter-irritation is much more effectual.

“‘This drug is of distinct value in practice, and should be in every dentist’s consulting-room.’

“But the introduction of the hypodermic use of it has caused me to alter or enlarge very materially my view and use of it, and I consider it has a great future before it.

“For some time I have been using solutions of hydrochlorate of cocaine of various strengths—5 per cent., 10 per cent., 15 per cent., 20 per cent., 25 per cent. solution—and with most satisfactory results; but the weaker ones I have discarded, and now use the three stronger ones.

“Of the cocaine faintness, &c., I have seen and heard very little, except in the Journals. In a Casual Communication of this kind I can hardly quote cases at length, but I will mention a few of the cases in which I have found it useful:—Extractions, torsion, removal of live pulp, inserting a hicory wedge between teeth in plugging, when filling teeth after rapid separation (Dr. Bogue’s separators, I believe, could be used with impunity, but I have not yet tried them); and all of these almost painlessly—at any rate with such little pain that it was easily endurable. In the cases of removal of pulps I have always applied it to the pulp itself also. A few days since I tried it applied in both ways, in a patient who had some exquisitely sensitive cavities at the neck on the buccal surface of some molars and bicuspid; but the result did not come up to my expectation; the patient said he certainly felt less pain, but that they were still painful.

“To-day I injected five minims of a 20 per cent. solution into my own gum, and five minutes afterwards I drove a hicory wedge in between my front teeth with a hand mallet, driving the wedge up against the gum as hard as I could. There was sufficient space between the teeth for plugging purposes, yet this, which appears to be one of the most

painful operations in dentistry, was performed with little or no discomfort.

"I hope too much has not been said that it has wearied, and yet enough to justify me in asking for a committee of investigation."

DR. WALKER said he quite agreed with Mr. Smale as to the desirability of appointing a Committee to investigate the action of cocaine, and should be very pleased to second the proposition.

The PRESIDENT thought that the matter had better be left for the consideration of the Council. It would be impossible for a large meeting such as the present to decide upon the scope of the inquiry, or to form a satisfactory Committee. If the Council had reason to think that such an inquiry was generally desired by the members, it would at once make the necessary arrangements.

MR. VANDERPANT showed two geminated bicuspidis which he had extracted from the mouth of a lady aged thirty-two.

The PRESIDENT remarked that it was a very interesting specimen, but he should rather describe it as a case of osseous union between the roots than as one of true gemination.

MR. W. WEISS said there was a specimen in the Museum in which there were three bicuspidis, two of them being geminated. Was one of these a supernumerary?

MR. VANDERPANT replied in the negative. He agreed that the President's description of the specimen was the correct one.

MR. REDMAN exhibited a model of the lower jaw of a lady aged forty-eight, who had recently erupted two supernumerary bicuspidis on one side, and one on the other; she had also two supernumerary teeth behind the wisdom teeth. Also a model of the upper jaw of a boy showing a supernumerary permanent lateral incisor; it had succeeded a similar deciduous tooth.

MR. WILLOUGHBY WEISS read the following letter, recently received from Mr. Alfred Coleman:—



*"To the Foreign Secretary, Odontological Society of  
Great Britain.*

"DEAR SIR,

"In the interesting paper by Dr. Dudley W. Buxton, 'On the Physiological Action of Nitrous Oxide,' I notice an almost unaccountable error the writer has fallen into in respect of myself, where, viz., at page 141 of the Transactions (March, 1886), he says, 'and Coleman pointed out that were oxygen liberated, it would probably produce the most baneful results upon the organism.' He further proceeds to demolish such opinion, and he can easily do so. 'However, this objection has little weight when we consider that it would be the tissues of the body which would take up the oxygen liberated from the gas and employ it for molecular integration.' But the writer he quotes distinctly says 'the liberated *Nitrogen*,' which greatly alters the question as put, and gives Mr. Buxton, as I think he will see, one of the strongest arguments in favour of his view, that nitrous oxide is not decomposed in the animal system. I think it might also be gathered from Dr. Buxton's paper that I had done little more in the matter than make the (misquoted) suggestion respecting the condition of nitrous oxide when taken into the circulation. The fact is that I devoted many weeks to the careful analysis of the products of respiration after its inhalation. At that time I was also in correspondence with my friend and former instructor, Dr. Frankland, and it was at my desire that he kindly undertook his interesting and valuable experiments on the subject, and to which Dr. Buxton refers. I am fully in accord with Dr. Buxton in his view that as an anæsthetic, nitrous oxide differs in a marked degree from ether, chloroform, or like compounds. I have in my own person, on several occasions, borne unpleasant experience to the fact that a condition prevails prior and subsequent to perfect unconsciousness produced by the first, when the sensations are greatly exaggerated, and when the pain of tooth extraction is an agony almost impossible to describe; whereas in the case of chloroform and ether I have been able on my own person to open abscesses, and even extract a molar

tooth, without feeling anything of the former, and very little of the latter. There are several other points in Dr. Buxton's excellent paper I could wish to allude to, but they would, I feel, exceed the proper limits of a letter. One matter in connection with this subject I may perhaps mention, as it may be of use to others. In New Zealand, as far as my experience goes, owing to the want of such admirable training in operating under anæsthetics as is offered at home by our Dental Hospitals, the operators are very deliberate, and by comparison slow. To get a longer period of anæsthesia under gas and ether I have been employing an instrument constructed on much the same plan as the chloroform inhaler (through the nose) described at p. 277 of my work on Dental Surgery, only for administering ether. In a recent case I believe I could have kept up the anæsthesia for an almost unlimited time.

“I remain, yours faithfully,

“ALFRED COLEMAN.

“*The Wood, Nelson, N.Z.,  
November 12th, 1886.*”

The PRESIDENT remarked that though Mr. Coleman was so far away, he evidently had not forgotten his old Society.

MR. HUTCHINSON proposed that a copy of the letter be forwarded to Dr. Buxton, and that his reply be published with the letter in the next issue of the Transactions.

MR. F. J. BENNETT thought it would not be in accordance with rule to publish anything in the Transactions which had not been brought before the Society. If Dr. Buxton had any answer to make to Mr. Coleman's communication it ought to be submitted to the Society before appearing in the Transactions.

MR. R. H. WOODHOUSE thought that Mr. Bennett's view was correct, but it was not necessary to discuss the point, since Dr. Buxton would have an opportunity of answering Mr. Coleman's criticism when he read the second portion of his paper, which was at present put down for the March meeting.

The PRESIDENT then called upon the Scrutineers of the ballot for their report, and they stated that the list of office-bearers recommended by the Council had been unanimously accepted. The list was as follows:—

## PRESIDENT.

Charles S. Tomes, F.R.S.

## VICE-PRESIDENTS.

*Resident*: Messrs. Henry Sewill, S. J. Hutchinson, and J. H. Mummery.

*Non-resident*: Messrs. Andrew Wilson (Edinburgh), Richard Rogers (Cheltenham), and G. C. McAdam (Hereford).

## TREASURER.

James Parkinson, Esq.

## LIBRARIAN.

Felix Weiss, Esq.

## CURATOR.

Storer Bennett, Esq.

## EDITOR OF THE TRANSACTIONS.

Frederick Canton, Esq.

## HONORARY SECRETARIES.

Messrs. R. H. Woodhouse (*Council*), Willoughby Weiss (*Society*), and C. J. Boyd Wallis (*Foreign Correspondence*).

## COUNCILLORS.

*Resident Members*: Messrs. Morton A. Smale, Arthur S. Underwood, E. G. Betts, J. F. Corbett, Thomas Arnold Rogers, Sir Edwin Saunders, John Fairbank, David Hepburn, and Ashley W. Barrett.

*Non-resident Members*: Messrs. J. R. Brownlie (Glasgow), J. H. Whatford (Eastbourne), F. H. Balkwill (Plymouth), George Brunton (Leeds), E. Apperley (Stroud), and J. H. Redman (Brighton).

The PRESIDENT then proceeded to deliver his Valedictory Address.



## PRESIDENT'S VALEDICTORY ADDRESS.

GENTLEMEN,

Time, with silent but ceaseless steps, has brought us to the close of another year of this Society's existence, and with it has brought the surrender of the honour and dignity you conferred upon me at its opening. I need not say how gratified I have felt in being allowed to serve you in the capacity of your President—a gratification which will be a pleasant remembrance to me to the end of my days, and for which I thank you.

Although the year has not been marked by any startling novelties in Dental Surgery, yet, upon the whole, there have been encouraging signs that the study of dental diseases and their treatment is still being pursued with that careful attention which must ultimately tend to the alleviation of those peculiar sufferings which claim our aid.

A most valuable paper was contributed by Dr. Dudley Buxton on "The Physiological Action of Nitrous Oxide," which every practitioner of our specialty would do well to master. It is a great advantage to be able to administer this beneficent agent successfully by the light of careful observation and practised skill, but the administrator will be the more assured in his administration by bearing in mind the physiological effects he is inducing in his patient; this knowledge gives him greater confidence and ease, and the reflection of this is seen in the increased confidence and ease manifested in the faces and minds of anxious onlookers, a no slight benefit to all—patient, friends, and operator. We had hoped that Dr. Buxton would have been able to have given us the conclusion of his most valuable and instructive paper, but, owing to his numerous engagements, that pleasure

which we should have enjoyed has to be deferred. We, however, thank him heartily for what he did give us, and we can only hope that at some future time he may be able to complete what he has so far contributed to our knowledge of the action of this now indispensable addition to Dental Therapeutics.

Mr. J. Bland Sutton, to whom we have often been indebted for valuable papers, furnished one of great interest on "Dental and Oral Cases in Animals," and coming from one who may be considered *facile princeps* in Comparative Pathology, his paper was, as might have been expected, full of information; the marked attention paid to it by those present testified to the interest felt by all in the cases he introduced to their notice. Such papers as these, although not coming absolutely within the scope of our daily practice, are nevertheless valuable as collateral adjuncts to our general knowledge, and are not to be neglected, for, as Solomon says, "men run to and fro in the earth, and knowledge increaseth." We live in an age of great mental activity, when the omnivorous reading public amongst the leisured classes read nearly everything, and not read only, but think on what they read; and as many of our patients come from that class, we ought to be prepared to give an answer to the intelligent questions that are oftentimes put to us by them. Therefore such papers as those furnished for us by Mr. J. Bland Sutton are of peculiar value, and we will hope that he may upon many occasions give us something from his well-filled storehouse of Comparative Pathology.

Histology, although not a branch of study absolutely required by the dental practitioner, is one which should engage the attention of the accomplished student, and which he can scarcely do without. There will be in the course of his practice many occasions when he may desire to investigate abnormalities in teeth or in other parts of the oral cavity, and to make himself familiar with their histological charac-

ters is a great gain in assisting his future diagnosis. We have to thank Mr. J. W. Groves for a considerable addition to our knowledge of histological manipulation by the valuable paper he contributed, and which I regret to say a serious illness prevented my hearing. To demonstrate the histological elements of even a simple membrane is not easy without a knowledge of the actions set up by different reagents and staining fluids suitable for this purpose. But such a paper as that given by Mr. Groves provides in a nutshell all the knowledge a busy practitioner need employ, and becoming familiar with the microscopical aspects of normal histology, he will the more readily detect pathological departures from this standard. Staining fluids have added new powers to microscopical research, and bring out the hidden elements of a tissue which otherwise would be lost to view, or only seen with difficulty. It was to direct attention to this valuable aid in histological pursuits that Mr. Groves' paper was directed, with that clearness which comes of close familiarity with the intimate working of this subject.

Mr. Wm. Storer Bennett, in a short paper, called our attention to the recent additions to the Museum. Under the endeavours of our former and present Curators we have become possessed of many valuable dental specimens, some of which may be considered unique, and under Mr. Bennett's care no chance will be overlooked which will result in enriching our collection and rendering it of still greater service in the furtherance of dental study. Some few of the recent additions are before you for examination this evening.

I know of no more fascinating study than that which peers into the obscurity of past ages, when the curtain of antiquity has long since fallen on the drama of that life enacted on the stage of man's earliest existence. It is a study so immense that it would not be possible, even if within our province, to call attention to each and every incident which helped to make up the sum of the daily life of that remote period; but



by the courtesy of my friend Mr. Wm. Cunnington I was enabled to present to your notice a number of fragments of human maxillæ possessing great interest as relics of the "Stone Age," that far distant period in the past before metal of any kind was introduced into use in Britain, and which archæologists state cannot be less, but may be considerably more, than four thousand years ago.

The jaws were massive in shape, the bone dense in structure, while the teeth presented every variety of erosion of the masticating surfaces, being worn away into deep pits in many instances. Only one case of dental caries occurred, but in one or two of the lower jaws the teeth were thickly coated with tartar. I made a rough microscopical analysis of this tartar, which I offered as my contribution that evening; it having struck me that as the salivary calculus which coats our teeth imprisons in its concrete any stray particles of food embedded in it, so this tartar of the stone age might present similar particles of food of that early period, and we might get some glimpse of the character of the aliment partaken of by these prehistoric men. Dissolving some small fragments of this tartar in weak hydrochloric acid and water, I decalcified it, and carefully washing and collecting the sediment I found the following organic remains of food:—husks of corn, hairs from the outside of the husks, spiral vessels from vegetables, husks of starch, the cell contents destroyed, the point of a fish's tooth, some round ruby-coloured bodies unknown to me, a conglomeration of oval cells probably of fruit, the barblets of down and portions of wool. The general mass of the tartar was made up of an amorphous mass of what might be disintegrated epithelium. In addition to these, this amorphous material contained a large quantity of sandy particles of two characters—one polarising and related to quartz, the other not polarising and evidently flinty. The erosion of the masticating surfaces of the teeth was doubtless due to the grinding of these particles between them in the act of eating. More recent examina-

tions have revealed cartilaginous plates the individual cells of which became easily detachable in numbers from the original piece.\*

Although the papers contributed to the Society during the past year have not been more numerous than is usually the case, we have had several interesting and instructive Casual Communications to fill their places ; consequently, this dearth may not be altogether regretted, but must be expected from time to time : for a paper suitable to be presented to such a Society as this, should be the outcome of many years' study and observation, well thought out, and every thesis proved ; therefore, under these circumstances, such papers cannot be of frequent occurrence. It may be possible to bring papers before the Society full of crude suggestions, hasty generalisations, and ingenious but intangible hypotheses, the main mission of which would be to stop a gap ; but they would be hardly acceptable to such a critical audience as that constituting the meetings of this Society. On the other hand, Casual Communications are always welcome, inasmuch as they oftentimes contain the germ of some practical application, which, being fertilised by discussion, becomes elaborated at the hands of other practitioners, and made available for the benefit of all ; whilst a paper to which a man has been giving undivided attention for years, and which he has made a personal and special study, however valuable and instructive it may be, is incapable of being discussed, because it surmounts the attainments of his audience in that particular direction, and they, failing to grasp the subject in all its fulness, a few questions are asked, and then it is finished by a vote of thanks to the reader for his valuable paper. Far be it from my wish

\* I have now reason to believe that the diatoms mentioned in my paper were accidentally introduced, but the presence of all the other constituents named has been verified by further examinations and by independent observers.

or intention to speak disparagingly of papers on selected subjects; but those papers can only come before us, if from out of our midst, by being taken up by those of our younger brethren who, possessing, or being supposed to possess, the requisite leisure, will devote their intellectual energies to working out some of the many subjects cognate to our specialty which may afford them an attractive field.

One feature of the events of the past year cannot be omitted from my necessarily brief summary, and that is the extreme pleasure we derived in holding out the warm hand of welcome to our provincial brethren, upon the recent meeting of the British Dental Association in London. It adds to our pleasure to know that our *conversazione* was thoroughly enjoyed by all those present, for by its means mutual friendships were strengthened, and personal acquaintance made with many whose names and work in the provinces were previously known to us only by that good reputation which had winged its way before them. Who can thoroughly estimate the effects of those encouraging confidences exchanged upon this occasion—the mutual confession of difficulties presented and overcome! many a young heart meeting with sympathy from those who have gone before them in making a practice, having borne the burden and heat of the day! We cannot thoroughly estimate the full effect of the words of encouragement passed on that occasion, but they will bear their fruit in the warm allegiance our provincial brethren will always feel towards this, the parent Society of the profession.

Our beloved Sovereign, who throughout her happy and prosperous reign has always encouraged and recognised worth under whatever guise it may have been presented to her notice, has during this year added another honour to our profession in dignifying one whom we all have looked up to and revered as our leader in every movement which had for its object the advancement of our specialty—one



whose literary and scientific achievements have been warmly appreciated by all who value and admire the thoroughness which characterises his labours, from whose first work may be dated our elevation as a special branch of surgery, and whom we hope may be long spared to us to guide us with his counsel, and encourage us with his approbation. I need not say that I allude to Sir John Tomes, for no man can fail to recognise to whom these remarks justly apply.

Now, gentlemen, I reluctantly bring my year of office to its close, but before doing so let me use this opportunity of publicly thanking those officers of the Society upon whose shoulders the great labour and responsibility of managing its affairs have fallen. It might seem invidious to mention them personally by name, therefore I will thank them in their corporate capacity for all they have done, during my Presidential occupation of this chair, to lighten my burden and smooth my path; and I feel I can in all justice assure you that while we have such men to serve us, our Society will never fall from the high and influential position it has attained.

## VOTES OF THANKS.

MR. GEORGE GREGSON then proposed a cordial vote of thanks to the President, who had so ably fulfilled all the duties of his office during the past year. He (Mr. Gregson) had seen many Presidents in that chair, and he felt sure that all present would agree with him when he said that Mr. Charters White would be associated with those who were specially remembered for the efficient manner in which they had discharged their duties and furthered the interests of the Society. He was very glad to see that Mr. White had so thoroughly recovered from the illness which had deprived the Society of his presence on one occasion. Long might he live and prosper!

MR. MORTON SMALE said he could not in Mr. White's presence say all that he should like to say about him; he was inclined to wish him absent, that he (Mr. Smale) might speak more freely. But he could not help remarking that the experience of Mr. White's year of office showed how much the successful and harmonious working of the Society depended on the tact and judgment of its President. He had great pleasure in seconding the resolution.

The members having expressed with hearty applause their appreciation of Mr. White's services,

MR. STOCKEN rose to propose a vote of thanks to the officers of the Society. It was fortunate in having so many members who were willing to devote a large amount of time to its welfare. It had in its Treasurer one who had long shown his interest in the Society, and in the Librarian one whose constant care was to increase his store. It was only necessary to walk through the Museum in order to realize the amount of time and labour devoted by the Curator to its improvement.

It was not easy to find a man in all respects suited to the post of Curator, and they all felt that in the present holder of the office they had secured a great acquisition. He would not detain the meeting longer, but would ask those present to give a cordial vote of thanks to all the officers of the Society.

MR. H. CAMPION (Manchester) said it was needless for him to say anything of the character of the officers, since they were as well known to his hearers as they were to himself, and would therefore content himself with expressing the pleasure he felt at being allowed to second the resolution as a representative of the provincial practitioners. There were a great many provincial members who were unable to attend the Society's meetings as often as they could wish, but it must not be thought that they took no interest in them. He could state most positively that this was not the case. They all took a pride and an interest in the Society, and therefore it gave him great pleasure to second the resolution.

MR. WEISS (the Librarian) replied that he felt sure that the officers of the Society so thoroughly appreciated the honour conferred upon them that they would be content to forego any further acknowledgment; still they would none the less appreciate the vote of thanks.

The work of the Curator and of the Librarian had been specially referred to. The enthusiasm of the former was evident, but his own duties were light, thanks to the completeness and good order to which the library had now attained. He thought, however, that the arduous, though perhaps less evident, labours of the Secretaries also deserved mention, and should certainly not be forgotten.

He had expressed a wish to retire in favour of a younger man, but his resignation had not been accepted, and he had consented to continue in office a little longer, but he wished it to be understood that he was willing to retire at any time.

He thanked the members for the kindness which they had always shown to the officers of the Society, and for which, he felt sure, the latter were all of them duly grateful.



The PRESIDENT said it only remained for him to thank the members for the very kind manner in which they had acknowledged his services. He could only say that his office had afforded him great pleasure, and he trusted that, relieved from the cares of office, he should continue for a long time to come a regular attendant at the Society's meetings.

The Society then adjourned.









Portrait of General Thomas H. Morgan

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THE NATIONAL ARCHIVES







# Odontological Society of Great Britain.

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## ORDINARY MONTHLY MEETING.

*February 7th, 1887.*

CHAS. S. TOMES, F.R.S., PRESIDENT,

IN THE CHAIR.

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The following nominations are now before the Council :—

ALFRED KENDRICK, L.D.S.Eng., Bridge House,  
Taunton.

WILLIAM BROMFIELD PATERSON, F.R.C.S. and  
L.D.S.Eng., 46, Brook Street, W.

Names.

The SECRETARY read the following letter from Mr. Jas. Parkinson :—

36, Sackville Street,  
*February 7th, 1887.*

DEAR MR. PRESIDENT,

I feel that the time has arrived when I must ask the Council to relieve me from the Treasurership of the Odontological Society.

I am sorry to say that the state of my health is still very

indifferent, preventing me from attending, as I would desire, to its affairs as Treasurer. I have been obliged to ask the same of the British Dental Association.

I may truly add that it is a source of great grief to me to sever myself from old friends and associates, but such time must sooner or later arrive.

I will take this opportunity of thanking the Council and the Society generally for their uniform kindness to me at all times and on all occasions.

I propose to hand over to my successor the balance I have in hand, and which will be at your disposal for investment or otherwise, as the Council may determine.

I am very pleased to be able to state that during the thirteen years of my Treasurership we have been enabled to add largely to our resources. I find on reference to the accounts of the year 1873, when I took the position of Treasurer, that our invested property amounted to £777; whereas in 1886 it amounts to £1,417. We have also during this period been able to furnish our rooms and add materially to the requirements of the Library and Museum; and when I hand over to my successor the balances you will have a sum equal to £2,460, or thereabouts. So that, having paid for all these advantages, you will have increased your resources since 1873 by nearly £1,600 in money.

Believe me always,

Yours most sincerely,

JAS. PARKINSON.

*Chas. Tomes, Esq., President,*

*Odontological Society of Great Britain.*

The PRESIDENT said that much as they regretted the loss of Mr. Parkinson's services, the Council felt that in his present state of health they could not ask him to continue to perform duties which must necessarily be attended by a considerable amount of trouble and responsibility. They could not, therefore, do otherwise than accept the resignation and tender him their thanks for the care he had taken of the Society's property during his term of office.

It was the province of the Council to fill the vacancy thus caused, and he felt sure the members would be glad to hear that Mr. Thos. Arnold Rogers had been prevailed upon to accept the office.

MR. WEISS said he was sure the members would not allow this announcement to pass without desiring to give formal expression to the gratitude which he knew they all felt to Mr. Parkinson for the services he had rendered to the Society during his long term of office. The Treasurer had sometimes very disagreeable duties to perform in pressing for payment of subscriptions, and still more when he was obliged to propose the exclusion of members from the Society; and it said a great deal for Mr. Parkinson's unfailing tact and good nature that, whilst he had performed his duties most efficiently, he had done so without exciting the smallest personal animosity towards himself. He (Mr. Weiss) trusted that Mr. Parkinson's health would soon improve, and that they might have the pleasure of seeing him again at the meetings, and of thanking him personally for what he had done. He proposed that the thanks of the Society be given to the late Treasurer for the great care he had taken in the management of the Society's property.

MR. CHARTERS WHITE said he had great pleasure in seconding the resolution. He had known Mr. Parkinson for a good many years, and could fully endorse all that Mr. Weiss had said with regard to his unvarying kindness and courtesy.

The resolution was at once carried by acclamation.

The Librarian (MR. WEISS) reported that the only addition made to the Library during the past month was the January number of the "Quarterly Journal of Microscopical Science."

The Curator (MR. STORER BENNETT) reported that the following skulls had been purchased by the Council, viz.: those of the velvet monkey (*Cercopithecus Lalandii*), green monkey (*Cercopithecus Callithrix*), ring-tailed coati (*Nasua Rufa*), kinkajou (*Cercoleptes Caudivolvulus*), Coypu rat (*Myopotamus Coypu*), Indian fruit-bat (*Pteropus Medius*), and brush-tailed kangaroo (*Petrogale Penicillata*). It would be noticed that



several of the teeth of the Coypu rat were carious. Mr. Howard Mummary had presented the skull of a Japanese pug, which showed extremely well the underhung lower jaw so characteristic of these animals; and to the Zoological Society (through the kindness of Mr. Bland Sutton) they were indebted for the presentation of the skull of an agouti (*Dasyprocta agouti*), in which the molar teeth were extensively affected with caries.

MR. BETTS exhibited models of a boy aged eight years and ten months, in which none of the milk teeth had been shed, nor had the first permanent molars been erupted. The boy's mother and the elder children of the family had retained temporary molars, and the mother had till quite recently a temporary incisor.

He also related the following case of the eruption of a tooth after the death of its pulp:—A lady, about thirty-five years of age, who had for some years been wearing a small gold plate supplying an absent right upper canine, came to him complaining of severe neuralgic pain, and also that lately her plate had ceased to fit owing to “a lump” in the gum beneath it. On examination it was found that the pointed tip of a tooth was just visible through a small orifice in the gum, and further that a shaft-like carious cavity led vertically up to the pulp which was fully exposed. Arsenic was applied, the pulp devitalized, and the root eventually filled, the gum having to be packed back to permit of the operation. Since then, as shown by the model, the tooth had completely erupted. A first bicuspid had originally occupied the space, but it had been destroyed by caries and extracted. The case was interesting as showing clearly how little a tooth itself had to do with the process of eruption, and that the force by which this was brought about was evidently external.

The PRESIDENT said the point to which Mr. Betts had called attention was certainly interesting. The tooth was dead and the growth of the root must have been arrested, yet the tooth had travelled down a distance equal to the length of its crown.

MR. HUTCHINSON remarked that another interesting point

in the case was how far the wearing of the plate had been instrumental in causing the eruption of the tooth. It had frequently been noticed that the wearing of regulation plates appeared to have the effect of hastening the eruption of teeth covered by them, and he thought it probable that this tooth might have remained hidden in the jaw but for the irritation caused by the pressure of the plate over it.

MR. HENRI WEISS thought that what took place in this case was very similar to the process by which a dead root was shed.

MR. STORER BENNETT read the following notes of a case of deep-seated abscess in the neck probably due to a misplaced and unerupted tooth:—

“I beg, Sir, to offer for the acceptance of the Society the second and third right lower molars removed from a patient aged seventeen, who was suffering from a deep-seated abscess in the neck.

“The patient, W. A., an anæmic-looking youth, who was said to have suffered from enlarged glands two or three years ago, was admitted to the Middlesex Hospital, under Mr. Henry Morris, on December 21st, 1886. He stated that about a fortnight previously he had noticed a lump the size of a hazel nut at the lower part of the right side of his neck in a line with the sterno-mastoid muscle; it gradually increased in size, but caused no pain, but eventually the face swelled, the lump becoming the size of an egg, and excessively painful.

“Mr. Morris requested me to see the patient, and on examination the neck presented a nodular swelling reaching from the right clavicle upwards to the lower border of the inferior maxilla, and conveyed a sensation of heat to the hand when placed upon it; it was very tender to the touch and indistinct fluctuation was detected on palpitation. The face was turned to the left side, and any attempt to restore it to its normal position caused great pain, the sterno-mastoid being rigidly contracted. His temperature registered 101°.

“Inside the mouth the separated roots of the first right lower molar were found to be slightly tender on pressure, but

the second lower molar, much decayed, was extremely painful when pressed upon. The wisdom tooth was absent and no signs of its imminent eruption noticed, the gum over it being normal in appearance and sensation. Pressing with the fingers on the gums around gave but little pain, the sulcus between the gum and cheek being scarcely swollen; in fact, although the second lower molar was extremely painful when pressed on, as though the periosteum were inflamed, there was an absence of the usual signs of alveolar abscess, and it seemed scarcely likely the swelling in the neck had its origin in dental disturbance.

“The roots of the first and second molars were removed, but no pus appeared in the sockets of either, and an attempt being made to evacuate the pus by forcing a probe through the socket of the second molar yielded a perfectly negative result.

“My colleague, Mr. Hern, however, drew my attention to a nodule of enamel which slightly protruded through the septum of bone between the second and third molar, and which was evidently a part of the crown of the unerupted wisdom tooth. On this being carefully examined I found that a probe could be passed both above and below the crown without at any part coming in contact with a root. The conclusion we arrived at was that the wisdom tooth was lying horizontally with the masticating surface pointing forwards, one of the cusps having protruded through the septum between it and the second molar, and against the posterior surface of which it had impinged. On examining the second molar more carefully a small pit was noticed on the distal root, the result probably of pressure of this misplaced wisdom tooth.

“In the afternoon the patient was conveyed to the operating theatre, as Mr. Morris intended to lay open the abscess, and at his request I made another examination after ether had been administered, and, having satisfied myself of the correctness of our opinion regarding the position of the tooth, made an incision over it, and readily raised it from its socket by means of an elevator. Mr. Morris introduced a



trocár and grooved canula into the swelling in the neck in a direction upwards and backwards, and freely enlarging the opening gave vent to a quantity of thick, creamy pus. On subsequently exploring the wound a probe could be passed up nearly to the gum.

“On the following morning patient’s temperature was 103°, but it fell to normal on the succeeding day, and his recovery was uninterrupted until January 20th, four weeks after the operation, when he began to complain of pain on the left side of his neck, and his face became swollen. In the evening the first left lower molar was removed by the House Surgeon, and on the following day Mr. Hern extracted the next molar to it, which, though carious, was less so than the one on the opposite side. From this time all pain in the neck disappeared, and he was soon pronounced convalescent.

“I subsequently examined the socket of the second left lower molar, and could detect the wisdom tooth by passing a probe backwards through the alveolar septum, but it appeared to be occupying its normal position.

“Granting that the abscess on the right side of the neck *was* due to the teeth, this case appears interesting—

“*Firstly*, from the swelling being almost exclusively confined to the neck, the usual symptoms of alveolar abscess being but very slight, and

“*Secondly*, the non-evacuation of pus on removing any of the teeth, for none appeared even on extracting the wisdom.

“Should it be objected, however, that cause and effect have not been satisfactorily connected, the case is still interesting from the mal-position of the wisdom tooth, and the coincidence (if it be nothing more) of the abscess in the neck on the same side.

“Had the patient presented himself for treatment when the swelling was first noticed it could, in all probability, have been cut short by extracting the second molar, as Mr. Hern eventually did when the abscess appeared on the opposite side.”

MR. WALTER COFFIN exhibited and explained the action of a little instrument designed by M. Rosenthal, of Liège, for the treatment of alveolar abscess. It consisted of a tube fitted at one end with a fine nozzle, and at the other with a rubber connection for attachment to a saliva ejector. To the lower part of this tube is attached another, a three-way cock or valve being placed at the point of junction. The end of this branch tube being placed in some antiseptic solution, the cock is turned so as to connect it with the saliva ejector by which the fluid is drawn up into the tube, completely filling it. The point of the nozzle being thrust into the abscess cavity, the cock is turned so as to connect it with the ejector, and part of the contents of the abscess is drawn into the tube. By turning the cock a little further, communication is opened between the abscess cavity, in which there is now a partial vacuum, and the antiseptic solution, which is thus drawn into the sac. This is again, by a turn of the cock, withdrawn, mixed with pus, into the ejector, and this operation is rapidly repeated until the contents of the abscess have been more or less completely removed. The saliva ejector should be able to produce a vacuum equal to six or seven inches of mercury, and it was a good plan to place a small piece of adhesive wax on the gum over the seat of the abscess and perforate through this. If any fistulous openings existed they must be closed.

Mr. Coffin also showed for Mr. C. J. Noble a model of the upper jaw of a woman with four molars on one side.

DR. WALKER said he had used M. Rosenthal's instrument about half-a-dozen times during the past month, and had been very pleased with it. He found that his saliva ejector worked it perfectly. It would, however, be an improvement if the lower tube were made somewhat longer.

MR. F. CANTON read the following extract from a letter received by Sir John Tomes from Mr. Chas. James Fox, a former member of the Society, and showed the tooth referred to by the writer. The letter was dated from Muskoka, Ontario, Canada.

“The enclosed tooth was given to me by a young lumber-

man, who brought it from an ancient Indian burying ground on the banks of French River, near Lake Nipissing, about 150 miles further north than I am. I know the lad well, and know him to be an honest, truthful fellow. He took it from a skull lying by what had been an India burial scaffold. As you doubtless know, they do not bury, but wrapping up the corpse in its buffalo robe, rest it on a frame supported by sticks. The reason I begged for the tooth was because I fancied that it was a specimen of erosion, and I remarked, 'Some of the dentists in the Old Country maintain that this erosion is due to the use of the tooth-brush; here certainly is a tooth that never saw a tooth-brush.' I have never heard of the North American Indians cleaning their teeth, as many natives of the East Indies do. If the tooth illustrates anything, let the Odontological Society's Museum have it, or put it in the fire."

MR. MUMMERY thought, from the naked-eye appearance, that the disease was more like superficial caries than true erosion.

MR. C. D. DAVIS showed models of the mouth of a girl, aged thirteen, with the following dentition:--In the lower jaw two incisors and the second bicuspid were absent; there was no history of the extraction of any permanent teeth, and no evidence of the presence of the missing teeth beneath the gum. In the upper jaw the left temporary lateral and both temporary canines were standing, and there was no positive indication of the presence of the permanent laterals or canines in the jaw.

The models were taken in March, 1886, but the patient was seen on the 4th inst., and there was no marked alteration in the mouth.

Mr. Davis also showed a model of the upper jaw of a young lady, aged twenty, with the temporary lateral incisors and canines still present, and the right permanent canine in line between the temporary canine and the first bicuspid.

MR. WILLOUGHBY WEISS showed a model of the upper jaw of a youth, aged twenty, in which the temporary canines were



retained whilst the permanent canines occupied the place of the permanent laterals which were absent.

MR. L. MATHESON made a short communication respecting the capabilities of the Tauber Hydraulic Press, exhibited at the November meeting of the Society. He could not offer as complete a report as he should like, because he had not been in possession of the machine long enough to test it in such a number and variety of cases as would alone warrant him in making a full and trustworthy statement as to its powers. But he was under a promise to some of the members to speak on the subject, and he would therefore briefly state what his experience with the machine so far had been.

The object of the invention was to supersede the ordinary zinc and lead casts and dies in the making of metal dentures by the employment of hydraulic pressure, applied directly to the plate resting upon a cast of Spence metal—a curious compound which it is possible to pour whilst molten into a Stent or gutta-percha impression, but which when cool is quite hard enough to bear a greater strain than zinc will stand.

Two claims were made for the machine. (1) That a great saving of time is effected by doing away with the necessity for the ordinary casts and dies. And (2) that a good fit is obtained with more ease and certainty than by the method now in use, owing to the principle of the appliance by which pressure is brought to bear *equally* on all parts.

Mr. Matheson's experience so far had been that in simple cases (an example of which was shown) the first of these claims was fully justified. In more difficult cases, such as those in which teeth stood high out of the gums, he had found it necessary to use a zinc cast to bring the plate roughly into position. With regard to the second claim, he found that in the ease and certainty with which a fit was obtained, the press far surpassed the ordinary method. One important point which he wished to note was that when teeth or gums were overhanging it was as easy with this machine to obtain a fit as in more simple cases; and this without being

obliged to make the accurate zinc casts which were so difficult to obtain under these conditions.

Mr. Matheson's experiments so far had been made with five gold plates, with the accurate fit of which in the mouth he had been extremely pleased, and with a number of German silver plates which he had fitted to plaster models. He felt that further experience with the press was required before a fair judgment could be formed regarding its working as a whole, but he hoped before long to make a further communication. He had, however, no hesitation in saying that he already looked upon the machine as a very valuable addition to his work-room appliances.

Mr. Matheson also showed a duct-compressor of Mr. Butcher's invention. It appeared to him to commend itself by its simplicity, lightness, and efficiency.

MR. ROBBINS said that having been somewhat dissatisfied with the results obtained from the ordinary methods of treating *Pyorrhœa Alveolaris*, he had read with great interest the paper by Mr. Whatford published in the August number of the Journal of the British Dental Association. Mr. Whatford appeared to speak very confidently of the results of his treatment by means of powdered sulphate of copper, and he (Mr. Robbins) felt a great desire to try it. In November an opportunity presented itself in the case of a lady, aged twenty-six, who had been in delicate health ever since an attack of rheumatic fever from which she suffered seven years ago. In March, 1884, she came to him to be treated for Riggs' disease. All the characteristic signs were present: spongy gums, gaping round the necks of the teeth, which were loose and surrounded with tartar, purulent discharge, &c. He tried the ordinary treatment, removed the tartar and applied aromatic sulphuric acid round the necks of the teeth, and obtained a very fair result. The state of the mouth was very much improved, but the teeth never became quite firm. In November, 1885, the patient returned; the lower right central and lateral were now so loose that he removed them and put in a plate. The same treatment was repeated, and again some improvement followed. But in November of last year she

presented herself in a worse state than ever, and Mr. Robbins determined to try the sulphate of copper treatment. Two more of the lower front teeth were so loose that he had to hold them in whilst packing the sulphate round them. He carefully removed the tartar and repeated the packing, and at the third visit a decided improvement was perceptible, and by December 2nd the patient appeared almost cured. But a relapse occurred, and on December 21st he was obliged to resume the treatment, this time with very satisfactory results, for the teeth were now in a far better state than they were two years ago. He knew that it was impossible to judge of the value of a method of treatment from one case, but he thought that there was something in this method of Mr. Whatford's, and he hoped that others would try it.

DR. FIELD said he had never used the method referred to by Mr. Robbins, but he had used aromatic sulphuric acid for some years, and had obtained good results from it. He doubted, however, the possibility of curing a case of true Riggs' disease. The symptoms might be palliated and the teeth retained for years, but he had never seen a case of true Riggs' disease cured. In treating this disease it was most important to get the conscientious assistance of the patient; they were generally very negligent. It was also important to thoroughly remove the tartar and to inject the acid deeply.

MR. ASHLEY GIBBINGS remarked that if the subject was to be fully discussed it would require an evening to itself. He would only state that he could confirm what Mr. Robbins had said as to the good effects of sulphate of copper. He had used it in two or three cases with most encouraging results. In one of these cases aromatic sulphuric acid had been tried and had failed, but after six applications of the powdered sulphate the patient was almost cured.

MR. F. J. BENNETT said the subject was well worth discussing, but it was obviously impossible to do so that evening. He hoped some member might be induced to bring it forward in a paper. He proposed the adjournment of the discussion to a future meeting.

This having been agreed to, the PRESIDENT proceeded to deliver his Inaugural Address.



## PRESIDENT'S INAUGURAL ADDRESS.

THE task which custom has imposed upon each successive occupant of the Presidential Chair of this Society is one which is beset with difficulties of a certain kind: difficulties perhaps hardly to be realised until they are encountered in the penning of an address.

For it would seem to be desirable to embody in it, if possible, something which has not been already said by one's predecessors, each of whom has thus narrowed the ground over which it might have been practicable to travel; something, too, which needs no lengthy nor detailed exposition, unsuited to the occasion, however well it might find place in a closely argued paper; a something, in fact, for which at this moment I look in vain.

In the wide field of Medicine and of Surgery this difficulty hardly exists, for a Presidential Address can almost always to good purpose concern itself with a retrospect of the progress which has been made in those directions in which thought has been most active during the preceding year; but within the sharply defined limits of our specialty, though I hope that we always have progress to report, the advances have often been in the way of details, the enumeration of which would be tedious; and hence I am not disposed to adopt the time-honoured course of giving a *résumé* of the work of the year, or of a few antecedent years—not that I would for a moment set slight value upon such periodical stock-taking.

Moreover, a comfortable indulgence in a course of mutual congratulation, pleasant though it may be, is far from being a wholesome mental diet; it is a more fruitful task to seek for

the weak places in our armour, if by so doing there is hope that they may be strengthened.

But if I have something to say in the way of criticism, so also there is much to be said in the way of apology for our shortcomings; and though perhaps to do so is to reverse the natural order of things, I will begin with the excuse before going on to the indictment. Year by year in the modern practice of dentistry we are able to do a little more for our patients, but our operations become longer and longer, so that it comes to pass that devoting, as we must do, hours to the treatment of each individual case, a very moderate amount of practice absorbs almost the whole of our time; whilst if we are fortunate in securing what may be termed a large practice our time from early morning till evening is filled up with an absolute completeness which, while it may be experienced by a good many general practitioners, is unknown to all but a very few of the consultants.

And so it comes to pass that the conduct of practice is a daily burden almost too heavy for even a strong man's powers, and we are for ever struggling with a chronic lack of time, and with arrears which never get overtaken.

Add to this that our operations entail much fatigue, hours spent in constrained positions striving with manipulative difficulties, which become more irksome as the day wears on, so that after work is done there is little energy left for devotion to any matter of serious study, and it is not hard to see why it is that research has fewer devotees amongst our ranks than we would fain have found.

And there is still another factor, a very real and potent factor too, which operates adversely to research, and that is the comparatively early period at which the more promising of the new recruits to our ranks secure a full employment of their time. For thus far the growing demand for skilled dental services, together with the increased consumption of time in the performance of dental operations, has brought it

about that with few exceptions students who have distinguished themselves above their fellows have become associated with older practitioners, and so, getting into practice years before they could possibly have made a position for themselves in the eyes of the public, have lacked that period of enforced leisure which has proved so fruitful of good work amongst young medical men. Our calling therefore handicaps us, and that somewhat heavily, and each one of us experiences a disposition to fall into a very deep rut of daily routine, not far short of a machine-like, automatic regularity in the performance of our daily duties.

But then it behoves us to look into it to see whether fate is altogether too strong for us, and if we cannot be saved from this form of mental deterioration; and it appears to me that there are means of escape after all, if there be the energy to grasp them. Perhaps the most valuable preventive is to have a hobby, a worthy one if possible, but at all events some hobby outside the lines of our daily work. That, however, is beyond the scope of the few remarks appropriate to the present occasion.

But besides this there is the necessity for approaching our work with thoroughly receptive minds, giving to it our very best powers, and striving to follow up every little clue, and to clear up every obscurity across which we stumble; if this be done there will be countless interests springing up every day, which will be a refreshment and not an added toil.

Perhaps to some this will seem a jeremiad for no cause; but let me illustrate what I mean by an example. I remember once being told that the subject was played out; that there was nothing left to work out, nothing to write about; but is it so? Is there any single thing about which we can flatter ourselves that we know it completely? Take the premature loss of the teeth, that disease which in its more acute form we call *Pyorrhœa alveolaris*, which every dentist is treating almost every day, for the most part with poor success. Do



we know all about that?—nay, more, do we know all that we could comparatively easily find out? There can be but one answer: We do not, though on both sides of the Atlantic reams of paper have been covered with *à priori* speculations and the like. To our shame be it said, we are in complete ignorance of the exact pathology of the disease, accessible though it be for study, and we treat it with a pure empiricism.

For my own part I will confess that until stirred up into inquiry by the eminently suggestive papers of Mr. Bland Sutton, who has happily often been found amongst us, though unfortunately for our credit he is not one of us, I was totally unfamiliar with the appearances which may be seen by a mere naked eye examination of dry skulls. There is, so far as I know, no place in dental literature where these appearances are noted, and *à fortiori* no record of microscopic examination of the affected bones, by which we might learn how widely the morbid process goes; and it need hardly be said researches into the conditions of the soft parts involved are equally wanting.

In the pursuit of every branch of knowledge there comes a time when that which lies upon the surface, patent to casual intelligent observation, has been worked out, and when for further progress a closer and deeper investigation becomes essential. I venture to think that if that closer investigation, with the aid of modern methods of research, were applied to our special problems a sufficiently rich harvest of results would reward the effort.

For so it has been in the wider field of Medicine and Surgery; the immense achievements of the antiseptic method have been the outcome of investigations into the nature of organisms which, but a few years ago, would have been deemed utterly outside the pale of the interests of the practical surgeon. So too in medicine: the nature of certain infective disorders, and the light thereby thrown upon others of which the history is as yet but incompletely known; the localisation of cerebral

function, and the brilliant results which, with the aid of antiseptic surgery, have resulted therefrom, all these things have been arrived at by a closeness of investigation which has as yet hardly been brought to bear upon dental problems.

Another enticing field for inquiry, which in the nature of things does not admit of so much accuracy, lies in the question how far heredity plays a part in the genesis of dental irregularities, and of dental caries. There are some irregularities which are quite obviously the result of accidental circumstances in the individual; but leaving these out of consideration, there remain a vast number which *à priori* would seem to be quite as likely to be under the sway of a strict heredity as is the conformation of a nose, or of the lips.

It has been rather the habit to assume that dental irregularities are things of quite modern date; thus my friend Dr. Norman Kingsley (like Sir Crichton Browne and his headaches of School Board children) would fain persuade us that it is all the effect of disturbed innervation, the result of over-pressure. But is this so? are irregularities so very recent? I am not at all prepared to say that we can diagnose with any certainty the existence of a dental irregularity from the appearance of the outside of the face; yet we can often make a good guess at it; as, for instance, when we see a child with open mouth and semi-idiotic look who is no idiot at all, we can guess pretty correctly that there is a contracted palate, enlarged tonsils, and maybe, too, a crop of adenoid growths in the pharynx. So if you look round the walls of the Grosvenor Gallery at the present time, where in a splendid series of portraits the unerring brush of Vandyke has handed down to us the faces of many of the cavaliers, we shall feel pretty confident that amongst them several were underhung, that one at least had protrusion of the upper incisors, and that two presented that excessive depth of the front of the lower jaw which is accompanied with much obliquity of the ascending ramus.

So too at the Old Masters' Exhibition at the Royal Academy, there are faces from which similar deductions may be drawn, and there is left upon one's mind a feeling that the mouths and lower jaws of the cavalier classes at that date were coarser than those which would be found to prevail were we to look at the faces of persons in a corresponding class of society nowadays.

Old family portraits are of much interest looked at in this connection. I am acquainted with one family in which, with rare exceptions, the mouth is very small and the jaws contracted and V-shaped to such an extent that it is plainly discernible upon the outside of the face. Now this appearance, forming a conspicuous part of the very marked family likeness which distinguishes them all, is clearly visible in the family portraits for many generations back.

If we stop to think what this implies it is the more remarkable, for the family portraits, the name, and the titles have of course gone down by the male side only, and we have an irregularity handed down for generations hardly weakened, although there have been other influences repeatedly introduced by marriages with various other families.

I have in mind another instance where the children reproduce an apparently slight character in the father's teeth, hardly, if at all, weakened by the infusion of another strain upon the mother's side. On the other hand, I know an instance of a girl's mouth being an exact copy of her mother's, the resemblance extending to such points as the disposition of the rugæ, and the grooved prominence in the median line of the palate; there is a strong facial likeness, and here the father's influence seems not to be traceable.

It may be that the terms of the problem are so complex as to altogether elude inquiry, but nevertheless it appears to me that a close observation of the mouths of children of large families, taken in conjunction with their parents, might not improbably throw a little light upon vastly wider questions of inheritance; at all events it is ground hardly explored,



and there is here room for what Professor Tyndal has happily termed the scientific use of the imagination, in furnishing us with a working hypothesis if with nothing more.

Hence one may be allowed to speculate a little upon matters which do not admit of more accurate proof, always provided that one is not thus led into mere speculation where more solid ground is accessible to us. One thing which has often struck every one who looks much at old portraits, is that the type of face which is held to be beautiful at one period is not that which is held to be so at another; the beauties of King Charles's day are not like those of the Georgian era, and neither again would be considered great beauties now-a-days. There is a fashion in beauty as in other things, and the tendency of late years seems to have been in the direction of the appreciation of a tapering form of face in which the mouth and lower jaw are not pronounced to the full; the full mouths and somewhat heavy lower part of the face of Charles' favourites would disqualify many of them somewhat from a place in a modern book of beauty.

I need hardly remind my hearers how largely the contours of the superior and inferior maxillary bones model the face, so that if there be a general facial resemblance, this will have been largely contributed to by resemblance in the form of these bones. And if dental irregularities go hand in hand, as I believe they very commonly do, with modifications of the maxillæ affecting a great deal more than the immediate alveolar borders, then coincidently with the transmission of facial peculiarities we may expect to find transmission of dental irregularities.

The question of how far the child is demonstrably a mean product, sharing the peculiarities of its parents, but bringing to light again tendencies inherited from more remote ancestors, is one of the greatest interest, and it seems possible that things which admit of measurement and of reproduction in the way of casts, such as we have in the jaws and teeth,

might throw some light upon it; even if the results were quite negative, that in itself would be an important basis of fact from which to study the matter in other aspects.

And it must not for a moment be supposed that it is a simple question, or that Nature yields up her secrets to casual questioners; for in every individual many strains of blood unite, and may be expected to assert themselves to varying extents. Nor can we expect to be able to obtain a complete series of models from any one family; as a friend suggested, the only satisfactory thing would be to obtain access to the family vaults of some stock presenting marked dental peculiarities.

With the material at present to hand we can only say that in the matter of teeth children may closely mimic either the one parent or the other; this of course we frequently see in the matter of general likeness, save only that in the teeth it is, so to speak, more measurable. Then, too, they may sometimes present a sort of blend; or some members may follow the one, and others the other parent; or again they may present characters not at first sight referable to either parent; it is this last which would seem to present the most fruitful field for inquiry.

Some years ago Mr. Francis Galton devised an ingenious method of, so to speak, striking an average of a number of faces, and bringing into prominence the points of resemblance by the help of photography.

If, for example, he wished to deal with five faces of members of the same family, he took the five photographs (which must roughly correspond in size and in the view of the face selected, whether full face, profile, three-quarter face, or what not) and arranged that they should in succession occupy the same spot upon a screen. Then he took a sensitised plate, requiring say five seconds exposure in order to give a good image, and exposed upon it in succession the five photographs for one second each; in the aggregate then the plate had

been sufficiently exposed, but each individual photograph had received only a fifth of its proper exposure, and so a thing which occurred upon one only would have been so under-exposed as to leave no appreciable mark upon the negative. On the other hand, that which was common to all would be amply strong, and so his method eliminated that which was peculiar to one or two. Treating photographs of members of our Royal Family in this way he obtained a "composite" Guelph face, which, whilst it was unmistakably a Guelph, yet represented no known member of the family.

The composite thus obtained is then a generalisation of the points of community. Is it at all possible that we might in some such way combine the characters of the dentitions of a number of the same family and thus arrive at a generalised family type of jaw? Of course this is mere conjecture, a mere hint thrown out which may prove to be worthless or worse, and I shall lay myself open to the reproach of that making bricks without straw which in the opening of my address I condemned. But it is only on such opportunities as an opening address that there is a chance of airing undigested notions, so I must plead this in extenuation of my inconsistency. It is perhaps also conceivable, to go on in the same strain of conjecture, that the popular idea of beauty for the time being may have something to do with the modification of the form of the jaws, at all events in particular classes of society. For it is very certain that the majority of people may be and are led in such matters; that we in point of fact learn to admire that which we are persistently told to admire as being really beautiful, and so popular pictures, periodicals, and the like may do much to inculcate a taste for a particular type. Now if you look round the walls of a picture gallery, if you turn over the pages of *Punch*, or look in the shop windows at the photographs of the professional beauties, you will, I think, be struck with the fact that the small-jawed type is the one now in vogue, and every



man who, swayed by this unconscious prepossession in favour of this type, admires and then marries a damsel of this type has done something towards its intensification. Perhaps this idea is far-fetched, but it seems to have some residuum of possibility about it, even if it does not admit of being pressed very far.

It is a fact unfortunately only too familiar that bad teeth run in families, and this with sufficient constancy to force it upon the attention of the public. And this bad quality of tooth, which renders it almost certain to be attacked by caries early in the life of its possessor, is not by any means always associated with a low standard of general health.

It would be equally conceivable that defective tooth formation might be due to malnutrition in the individual during the period of active tooth-building, or to an inherited tendency; but in seeking to learn which is the more probable hypothesis there are one or two collateral facts which may help us.

There seems to be a certain fixity of type about teeth which renders them a little less susceptible to stunting, starving influences than the bones which support them; thus in rickets, although the maxillæ are stunted, the teeth are often full-sized; again in short-muzzled dogs the reduction in the length of the bones has not brought about a corresponding reduction in the teeth, so that these come to be crowded—a fact analogous to this being every day observed in the mouths of our patients.

Though it is difficult to describe in words the different grades or qualities of teeth with which we meet, yet we recognise with certainty by the eye those stoutly built, dense-looking, yellowish teeth which possess such great resistant powers; and on the other hand there is a sufficiently distinct type of greyish or bluish tooth, generally very translucent, which experience tells us is of very poor quality; whilst between these extremes are several sufficiently distinct types.

Upon the whole the colour of a tooth is not a bad index of

its quality, any approximation to a greyish or greenish hue, in fact to cold colouring, being of bad import.

Now we find that quite trivial peculiarities in the teeth, such as the dwarfing of a lateral incisor, are inherited with great frequency ; we find, too, that complexion, colour of hair, &c., and a vast number of other points are accurately transmitted, so why not quality of teeth ? There being thus no *à priori* improbability in a type of tooth being inherited, it would be well worth while to investigate the question whether the health of the growing individual or heredity has most to do with determining the quality of the tooth substance, and as most of us have whole families passing under our notice the difficulties of obtaining data are not great.

The easiest and most certain method of recording observations is to use a "string of shades," such as Messrs. Ash sell for matching colours of artificial teeth, only the teeth upon it should be selected with reference to their representing typical strong and weak teeth, and each slip stamped with a distinctive letter. With a very trifling expenditure of time the type of teeth presented by the father and the mother could be recorded, as well as those of the children ; it would soon appear whether there was or was not any relation between them, and a negative result would by no means be without its value, for it would render more hopeful the prospect of influencing the teeth of a growing child by diet and general hygiene.

One may remark, in passing, that although the temporary teeth are, so far as appearances go, almost always of good quality, this fact does not at all militate against the permanent teeth being under the strict influence of heredity ; for other race peculiarities, such as family likeness, &c., only develop themselves later on in the life of the individual, and sometimes even quite in advanced life.

Thanking you alike for the honour which you have conferred upon me in placing me in the Chair of this Society—a

Chair which has been occupied by so many whom I cannot hope to emulate—and for the patience with which you have listened to this congeries of inadequately considered and imperfectly expressed conjectures, I can only hope that during my Presidency our meetings may be profitable and interesting, and if they fail to be so it shall not be from want of endeavour upon my part.

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The PRESIDENT said it only remained for him to thank, on behalf of the Society, the various contributors to the business of the evening, and to announce that at the next meeting (March 7th) Dr. Dudley Buxton would read the concluding portion of his paper on “The Physiological Action of Nitrous Oxide.”

The Society then adjourned.



# Odontological Society of Great Britain.

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## ORDINARY MONTHLY MEETING.

*March 7th, 1887.*

FELIX WEISS, L.D.S.ENG., LIBRARIAN, IN THE CHAIR.

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ON taking his seat the CHAIRMAN said he was sorry to have to state that the President was suffering from the effects of his close attendance on his father during his recent serious illness. The members would, however, be glad to learn that Sir John Tomes was now progressing favourably, and though not safe from the risks of a relapse, might be considered to be free from any immediate danger.

The Minutes of the previous meeting having been read and confirmed,

The CHAIRMAN announced that the following gentlemen had been duly nominated as candidates for membership, and would be balloted for at a subsequent meeting, viz. :—

MESSRS. WILLIAM BROMFIELD PATERSON, F.R.C.S., and  
L.D.S.Eng., 46, Brook Street, W.

ALFRED KENDRICK, L.D.S.Eng., Bridge House,  
Taunton.

C. A. HAYMAN, L.D.S.Eng., Belle Vue, Clevedon,  
Bristol.

The following candidates were then balloted for and elected members of the Society :—

MR. FREDERICK ARTHUR CANTON, L.D.S.Eng., 34, Baker  
Street, Portman Square, W., as a Resident Mem-  
ber ; and

MESSRS. WILLIAM CASS GRAYSTON, L.D.S.I., 11, Valley Bridge Parade, Scarborough;

OSWALD FERGUS, L.D.S.Glasg., D.D.S.Univ. Pennsylvania, 41, Elm Bank Street, Glasgow; and

WALTER GLAISBY, L.D.S.I., 4, St. Leonards, York, as non-Resident Members.

The LIBRARIAN announced that he had received during the past month copies of the last edition of Richardson's "Mechanical Dentistry," and of Harris's "Principles and Practice of Dentistry." The Library had previously contained only somewhat antiquated editions of both these works.

MR. AUGUSTUS WINTERBOTTOM showed in full working order what appeared to be a most successful adaptation of electricity to dental requirements, and gave a practical demonstration of its capabilities.

Having about eight months ago met with an accident to his leg, which effectually prevented his using the treadle of the ordinary dental engine, he was obliged to seek some motive power other than his own foot.

Water motors were first tried, but proved unsuccessful, owing to the impossibility of obtaining reliable and adequate pressure. He then turned his attention to electricity, but again met with numerous failures. He tried several kinds of battery, but they all proved expensive and troublesome, requiring more or less constant attention and frequent recharging, as well as being liable to get out of order, and failing to supply an adequate current at the very moment when their continuous working was of the greatest importance.

Becoming wearied with these frequently recurring annoyances, he was beginning to consider the advisability of procuring a gas engine and dynamo, so as to work from secondary batteries, when he was fortunate enough to meet with an electrical engineer, Mr. March, who most successfully grappled with the difficulties and solved the problem.

After many experiments and much mutual consultation, a system was elaborated which thoroughly satisfied all ordinary dental requirements. Mr. Winterbottom had derived so much comfort from its use, and had been enabled to perform mechanical operations so much more quickly and efficiently, that he thought it might help some of his brother practitioners if he exhibited the adaptations before the Society.

Mr. Winterbottom then proceeded to explain the working of the apparatus, and expressed his willingness to give a further demonstration at the close of the meeting. The electrical current was generated by a zinc and carbon battery of eight pairs of cells, which would run a double set of apparatus and require no recharging for from fourteen to twenty-one days, according to the amount of work done. Two solutions were used, nitrate of soda and dilute sulphuric acid, and it could be easily emptied and refilled in about half-an-hour by means of compound syphons. He had had the battery in use for about four months, and had not yet found it fail, even in foggy weather, when it was supplying both light and motor all day. He found that the entire cost of wear and tear, including fluids and new plates, amounted to sixpence a day, or about half-a-crown a week.

The strength of the current was readily controlled by means of a "switch-board," by which it was made to pass through a series of resistance coils, and the amount of energy regulated to suit the needs of each instrument.

It could be made to drive the dental engine through the instrumentality of an ordinary electric motor. This was slung to a rod or beam overhead in such a manner that its position could be easily altered, and it was quite out of the way.

The speed could be varied from 1,500 to 4,000 revolutions per minute, and owing to the rapidity and steadiness of its action a tooth could be cut away much more quickly, and with much less pain to the patient, than when the ordinary pedal action was used; it cut also with but little pressure, without any fatigue to the operator, and his body



being perfectly steady the instrument could be directed with the greatest nicety, and without any risk of accidental slips. This ease and painlessness were especially noticeable in cutting down roots, or where a considerable portion of a sound tooth had to be cut away ; in such cases the saving of time was very considerable. So also in cutting down gold fillings, easing bites, inserting Herbst's fillings, &c. With proper adjustment the current could be made to work the Bonwill mallet, and lastly it was extremely useful for illuminating purposes.

He used three forms of electric light. One was an adjustable standard light with reflector; another the small light for examination in the mouth with which all were well acquainted, whilst the third was attached to a band fitting round the head and forehead of the operator; this was very useful for operations in which the operator would otherwise unavoidably get in his own light. These lamps gave a steady white light, the intensity of which could be varied at will, and he had not found them in any way trying to the eyes. Indeed he had been assured by an ophthalmic surgeon that no danger to the sight need be feared from this cause, but that on the contrary straining the eyes by working with a bad or insufficient light was far more harmful.

The CHAIRMAN thanked Mr. Winterbottom for the trouble he had taken in bringing all his apparatus and fitting it up in the room, and congratulated him on his very successful demonstration. He knew that other members had been experimenting in the same direction, and some of them would, he had no doubt, have something to say on the subject.

MR. GEO. BRUNTON said he had made trial of the electric light for dental operations, and could not speak as favourably of it as Mr. Winterbottom had done. One great objection to it was the strong shadow it threw. He would suggest to Mr. Winterbottom that a reflector coated with plaster of Paris would be found to give a much pleasanter light than an ordinary metallic reflector.

With reference to the engine motor, he thought, judging

from his own experience, that the *lowest* speed mentioned (1,500 revolutions per minute) was too fast.

MR. E. LATCHMORE said he had been using a similar arrangement to that exhibited by Mr. Winterbottom for about four months, and he readily endorsed all that that gentleman had said in its favour. As to the speed, he did not find the highest rate (4,000 revolutions per minute) too much. It did its work with great rapidity, and almost painlessly, its advantages being specially noticeable in such an operation as cutting away part of the crown of a molar to get at a posterior root. He had recently had a difficult extraction in which he found it most useful. Finding it quite impossible to remove a lower canine by the ordinary methods, he gave ether, extracted the first bicuspid, rapidly cut away the septum between it and the canine, and levered out the latter tooth from behind. He could not have done this with the ordinary pedal engine, except with a considerable amount of difficulty.

MR. HERN showed for Mr. C. D. Davis, of Brixton, a good specimen of overgrowth of the rodent teeth of a rabbit, due to mal-apposition.

The CHAIRMAN then suggested that as there was an important paper on the agenda, and it was desirable to allow as much time as possible for discussion, the other Casual Communications which were put down for that evening should be postponed until the next meeting.

This having been agreed to, the Chairman called upon Dr. Dudley Buxton to read his paper on "The Physiological Action of Nitrous Oxide."

*On the Physiological Action of Nitrous Oxide Gas.*

BY DUDLEY WILMOT BUXTON, M.D. and B.S.Lond., M.R.C.P.,  
Administrator of Anæsthetics in University College Hospital,  
the Hospital for Women, Soho Square, and the  
Dental Hospital of London.

IN a preliminary communication made before this Society\* I attempted to review some of the more authoritative views which have from time to time been advanced with regard to the physiological action of nitrous oxide upon the organism. It remains for me to consider the evidence which experimental research has placed in our hands, and to attempt as briefly as may be to formulate what conclusions are warranted by the results of such researches; and further, to adduce from these conclusions practical rules such as may guide us in the employment of nitrous oxide gas as an anæsthetising agent.

Aeriform bodies can only obtain ingress into the vital system of warm-blooded animals by absorption and diffusion through mucous membranes; practically this absorption is in the higher mammalia confined to the vast expansion of surface afforded by the acini of the lungs. Passing through the sinuous nasal meatuses, aeriform bodies are

\* See Trans., Vol. XVIII, N.S. (March, 1886), p. 133.



warmed, and sifted, so to speak, of floating solid particles; they then traverse the guardian portals formed by the larynx, and so enter the lungs. Usually the constrictors of the pharynx maintain a closure of the œsophagus; however, timid persons, whilst inhaling nitrous oxide, make efforts at swallowing, which, by partly inflating the stomach, may give rise to unpleasant effects, nausea or mechanical interference with the action of the heart, and so leading to syncope. This should of course be avoided.

So thin is the wall of the acini and air-cells, that the lungs may be considered as consisting of aeriform matter, separated from liquid matter by an exceedingly tenuous animal membrane, which is capable of the active interchange of gases from the aeriform matter to the liquid matter, and *vice versa*. Whatever aeriform body is inhaled into the lungs, provided it does not impede the mechanical acts of respiration, can diffuse into the blood, while the gases in the blood can diffuse out into the free air space of the lungs. Gaseous bodies we know exist in at least two conditions in the blood—(1) in mere solution, (2) in combination with the albuminoids found in the corpuscles and serum. The essential conditions of life for the organism are that in proportion as the bodily tissues are split up for the production of movement, or force, heat, electricity, and so on, so should the blood

obtain organic material from the alimentary tract, and oxygen wherewith to build it into the tissues ; and secondly, that the blood shall be also depurated of organic and saline refuse, and of aeriform impurities through mechanism supplied by the lungs. This, I need hardly remind you, consists in the diffusion of carbonic acid gas and other obnoxious materials from the blood into the residual air in the air space, and the diffusion into the blood of oxygen from the residual air. So long as the oxygen tension is higher and the carbonic acid tension is lower in the residual air, so long will interchange between blood gases and atmospheric gases take place. When, however, other aeriform bodies than atmospheric air find their way into the air space of the lungs, other conditions are imposed upon the organism. Let us consider these. If the gas be respirable, and actually enters the lung space, it will obey the laws of diffusion, and in course of time displace the residual air. Then, being brought into close contact with the blood, it will either simply allow of diffusion out of blood gases, and, provided its tension in the lungs is above that in the blood, diffuse into the circulation and so reach the tissues, there to be rejected or built into their substance according as it is available or not for their metabolism ; and if it is able to link itself into chemical union with some constituents of the blood it will travel so

combined to the tissues, and more or less profoundly influence their behaviour according to its own vital peculiarities.

Let us consider to what class nitrous oxide gas belongs, and what is the *rôle* it plays in the blood. Priestley found nitrous oxide was readily absorbed by water, in a proportion of one-half its bulk. When carbonic acid gas is present in the water no absorption of nitrous oxide takes place ; but according to the careful experiments of Davy, when water saturated with nitrous oxide is brought into contact with carbonic acid, the latter ousts the nitrous oxide, becoming absorbed while the nitrous oxide is liberated. According to the same authority nitrous oxide will displace oxygen and air from water. When we remember that blood consists of 78 per cent. of water, we see these researches have a very important bearing. Neutral saline solutions, further, possess very feeble attraction for nitrous oxide. None of the older observers investigated the behaviour of nitrous oxide toward water in which albuminous material was present, and my investigations in this direction are not, I think, sufficiently definite for me to venture upon *ex cathedrâ* utterances ; but it seems probable that albuminous solutions of various strengths are possessed of powers of absorbing nitrous oxide other than those inherent in pure water.



The presence of nitrous oxide in the air space of the lungs is of importance in the following relations:—(1) By methods in use in this country oxygen is practically excluded, and, were oxygen admitted together with nitrous oxide, it is probable, our present knowledge tells us, that the oxygen would not be ousted by the nitrogen compound; and (2) the effect nitrous oxide has upon the elimination of carbonic acid gas from the lungs.

1. The deprivation of oxygen leads to asphyxia pure and simple; for example, if a person inhales in an atmosphere of nitrogen, although all carbonic acid (dioxide) diffuses out, yet asphyxial symptoms, hyperpnœa, dyspnœa, and convulsions, appear.

2. Now does nitrous oxide in any way interfere with the elimination of carbonic acid (dioxide) from the lungs? Careful experiments have shown that nitrous oxide affects carbonic acid elimination in only an indirect way.\* During the cutting off of oxygen supplies, the tissue metabolism, whereby carbonic acid and water are thrown into the circulation, is greatly lessened, and as a consequence the production of carbonic acid is decreased, so that in this case the diminished elimination is merely an indication of lessened production. We find a marked similarity between the tissues rendered stagnant by nitrous oxide,

\* Amongst others I may mention those of Davy, Frankland, and the careful and painstaking researches of Coleman, published by this Society.

and the sluggish behaviour of organic matter in animals during hibernation. At the same time there is a fairly active carbonic acid elimination, as much in fact as represents the tissue waste during the period of anæsthesia; and this carbonic acid, in the absence of recuperative oxygenation, is, I submit, an important matter requiring our attention when we have to take into consideration the practical lessons the physiology of nitrous oxide narcosis teaches. Here I will briefly say it seems consonant with these lessons that we should ensure the removal of this carbonic acid so that the patient may not breathe and re-breathe nitrous oxide polluted by it.

We may then take it that the blood is capable of acquiring nitrous oxide by simple absorption, and probably by the union of that gas with the albuminous materials found in the liquor sanguinis and corpuscles. No attempt has as yet succeeded in demonstrating the conjunction of nitrous oxide with hæmoglobin—at least no crystallised forms have been found, such for example as we are cognisant with in the case of nitric oxide hæmoglobin. However, in the last case we have to bear in mind the fact which was pointed out long ago by Davy, that nitric oxide possesses a strong affinity for the salts of iron, so that it is perhaps not unwarrantable to suppose the iron-containing hæmoglobin should readily unite itself in actual

chemical union with nitric oxide. But nitrous oxide can, as we have pointed out above, actually oust oxygen from its condition of absorption, and must with great rapidity become intimately associated with some of the blood constituents in order that it may be wafted, with the extraordinary rapidity we all are aware of, to the nervous centres, there to bring about that profound change in the nerve tissue which is evidenced externally by the anæsthetic coma of nitrous oxide narcosis. Researches made by means of the spectroscope upon blood when it is impregnated with nitrous oxide, do not, at least to my mind, afford us evidence of value. MacMunn, whom I have before quoted, failed to obtain any characteristic spectrum from the blood of animals poisoned with nitrous oxide. I have repeatedly made the attempt to obtain a spectrum peculiar to this agent, but have also met with want of success, the only bands discernible being the broad one between Fraunhofer's D and E lines, which of course merely represents the spectrum of reduced hæmoglobin. My friend Dr. Halliburton, Assistant Professor of Physiology in University College, was good enough to examine some blood for me, and he concurs in the results given above. Now this negative evidence cannot, I submit, be taken as sufficient for us to base conclusions upon which deserve to be reckoned final. The present methods



at my disposal preclude me from ascertaining the condition of the blood when nitrous oxide in quantity sufficient to induce anæsthesia is given along with oxygen. I hope to be able to conduct this research later on; but as it necessitates a Fontaine's chamber I can only prosecute it in Paris. Under the present circumstances, *pari passu* with the introduction of nitrous oxide we have the reduction of the hæmoglobin by the tissues, hence the spectrum of reduced hæmoglobin which is found.

In all experiments upon Mammalia with nitrous oxide gas, methods have been adopted which not only ensure a supply of the gas entering the lungs, but at the same time cut off the ingress of oxygen, so that there must in these cases always be a danger of confounding the symptoms due on the one hand to nitrous oxide, with those upon the other which arise solely from the deprivation of oxygen. And further, in some experiments which we shall shortly have to consider, a third set of symptoms intrude themselves, namely, those dependent upon re-breathing noxious exhalations from the lungs. It is incumbent then upon us to make allowance for these sources of confusion.

It has been my endeavour in my own researches to eliminate as far as possible those conditions giving rise to serious fallacies in deducing conclusions, by conducting control experiments in

which asphyxial phenomena were brought about. Further, by the use of an expiration valve in my tracheal canulæ, I have attempted to obviate accumulation in the lungs of mephitic material. I am quite sure that much of the erroneous teaching which even now is rampant, and which regards nitrous oxide narcosis as merely asphyxia, arises from neglect of the above precautions.

Among experimental researches I think we must place Sir Humphry Davy's first, not only in priority, but in excellence; for considering the limited means at his disposal, and the imperfect knowledge of physiology which existed in his day, we must admit his research was worthy of so great a philosopher.

In one series of experiments Davy placed cats, dogs, guinea-pigs, rabbits, mice, and birds under bell-jars filled with nitrous oxide by displacement over water, and allowed them to respire the gas. In some cases he noted much excitement, followed by loss of sensation, and final death through cessation of respiration. He removed certain of his animals from beneath the bell-jar, and placing them before a fire watched their recovery. Curiously enough, he observed that in many instances the animals were more or less paralysed, some being hemiplegic and some paraplegic—at least such appears from his statements to have been their condition.

In his second research Davy compared the behaviour of animals immersed in nitrous oxide with those placed in hydrogen and others kept below water. Reasoning from these experiments he says, "there was every reason to suppose that their (the animals') death in nitrous oxide could not depend upon the simple privation of atmospheric air; but that it was owing to some peculiar changes effected in the blood by the gas."\*

But these experiments, like those of many subsequent observers, are open to the criticism that the method employed confounded asphyxial with nitrous oxide effects.

Krishaber's researches, made chiefly with rabbits, may be considered under two categories: those in which nitrous oxide with small undetermined quantities of air was employed, and secondly, when, the animal being tracheotomised, nitrous oxide only was breathed. His conclusions are that nitrous oxide narcosis differs wholly from the asphyxial state, for, as he justly points out, no true anæsthesia is brought about in asphyxia, whereas entire loss of sensation and voluntary movement come about in a minute when nitrous oxide is employed. With Krishaber's subsequent attempt to institute a comparison between nitrous oxide narcosis and the anæsthetic sleep of chloroform we have in the present connection nothing to do.

\* Collected Works, vol. iii, p. 204.



Amory of New York has done some very valuable work upon the physiology of nitrous oxide; he investigated the gas expired during the inhalation of nitrous oxide, and further repeated Davy's experiments by placing pigeons under bell-jars filled with nitrous oxide by forcing in that gas above and letting out the atmospheric air below. Dr. Amory's researches, both those quoted and those which I have for the present passed by, are altogether admirable, and throw much light on the difficult question under review.

It appeared evident to me that nitrous oxide gas exerted a very considerable effect upon the nervous system, and I was anxious to undertake experiment in the direction of the ascertainment whether or not it produced physical changes in the condition of the brain. One way in which it was possible to investigate this point was to examine the actual changes, if any, in the brain whilst the animal was placed under nitrous oxide.

Accordingly the experiments were made, by the kindness of Professor Victor Horsley, at the Brown Institution.

The skull of a medium-sized dog was trephined, and nitrous oxide gas given through a tracheal tube fitted with a very freely acting expiration valve. The trephine hole exposed the outer third of the sigmoid gyrus on the right side. Under normal conditions the brain was seen some mea-

surable distance beneath the bone, pulsating quietly and synchronously with the respiration. The colour of the brain covered with pia mater was pinky red, or, more exactly, vermilion.

As soon as the animal began to breathe nitrous oxide, the respiratory rhythm being interfered with, the brain pulsations became more notable and somewhat hurried. When the gas was pushed, and the animal made to take it in freely, the brain substance was seen to swell up and gradually reach the trephine hole. The colour now began to change, and a dark, blue-red shade appeared to creep over the exposed brain, robbing the brightness of the vermilion and replacing it by a laky purple. The brain undulations were at this stage found to lessen in frequency and amplitude. The brain substance still increased in volume, and even protruded without the trephine hole, almost motionless, and of a pearly, glistening lustre of bluish hue. The vessels, examined with a strong lens, presented the well-known look of commencing stasis. At this stage the nitrous oxide was stopped and the animal allowed to inspire air freely. Quietly and gradually with each successive breath of air the brain receded, the undulations returning and resuming their normal rhythm and range. With these changes came a return of the vermilion tinge which characterises the healthy brain substance. This experiment was repeated; in some

cases the animal was anæsthetised by means of a face piece with an expiration valve, and in others a tracheal tube was introduced, but the phenomena observed were strikingly uniform. It was next determined to conduct a control experiment, first pushing the nitrous oxide to the verge of death, and subsequently producing asphyxia by deprivation of all air.

In the experiment in which nitrous oxide was given, the brain being exposed as in the last research, the gas was pushed until respiratory movements completely ceased. In a little over a minute (1 min. 10 secs.) the brain substance had become livid and swollen to above the calvarial edge; the animal was absolutely insensitive to painful sensation; his limbs showed marked jactitations. In about 1 min. 30 secs. normal respiratory movements had ceased. Artificial respiration was promptly had resort to, and speedily the natural thoracic movements were resumed. The trachea was then occluded and the brain observed. In about a minute the brain substance assumed a deep purple dull hue, which in another half minute became very intense; the brain then began to recede, sinking deeply from the trephine hole. In two minutes the sphincters became relaxed and further sinking of the brain took place. In three minutes the respiration movements were very profoundly interfered with, only manifest-



ing themselves by long-drawn gasps which were separated by long intervals. In five minutes, although all respiratory movements had ceased, the heart still beat. In six minutes access of air was allowed, but artificial respiration failed to effect recovery.

These experiments appear peculiarly instructive, firstly, as showing in a very marked way the difference between the brain condition when fed with nitrous oxide-laden blood, and when supplied with deoxidised blood containing tissue refuse; and secondly, when viewed in relation with the clinical phenomena of nitrous oxide narcosis. As I pointed out in my last communication to this Society, there is a zone of hyperæsthesia which separates the normal consciousness from the absolute loss of sensation on the one hand, and on the other which unites the stage of oblivion, or sleep, with the return to full mental activity. It is presumably at this epoch that the dreams of mental exaltation and physical joy occur, and it is then that slight external physical stimuli—*e.g.*, a flash of light, a noise, a movement—will become a thousandfold magnified and perverted in the patient's brain. The peculiar filling of the brain would seem to offer a physical counterpart for these mental conditions, and apparently rapidly so modifies the brain cells that they are incapable of further reception or ideation: an initial increased

exaltation gives way to a complete abeyance of function.

Experiments in the same lines were also made with regard to the action of nitrous oxide upon the spinal cord.\* The animal being under the influence of chloroform and curare, the laminæ of the lower dorsal and lumbar vertebræ were removed and the cord exposed lying in the spinal canal. The animal was then made to respire nitrous oxide, only expiring through a slit in the canula. A very marked effect soon showed itself: the cord gradually enlarged and cerebro-spinal fluid began to well out, showing the enlargement of the whole length of the cord. This experiment was repeated, and the same result was always obtained. However, as will readily occur to you, two causes might have conceivably produced this effect, namely—(1) the exclusion of oxygen, *i.e.*, the asphyxia, or (2) the presence of nitrous oxide. To test which of these possible factors was really responsible for the swelling up of the cord, the animal was deprived of air, and no nitrous oxide given. At first the cord remained unchanged—at least no swelling took place, and no escape of cerebro-spinal fluid occurred. Soon, however, as the blood became more and more deoxygenised, the cord grew smaller, shrinking below its former level in the spinal canal.

\* These experiments were made at the University College Physiological Laboratory, and I am indebted to Mr. John Rose Bradford, B.Sc., for their execution and to Professor Schäfer for the use of the Laboratory.

There was no doubt but that while in nitrous oxide administration the cord, like the brain, grew larger, in asphyxia it shrank. To test this effect further, the following crucial experiment was tried. The animal was subjected to asphyxia, and the cord was watched until it had perceptibly shrunk, when nitrous oxide was allowed to enter the lungs. If, as we assumed, nitrous oxide was capable of dilating the vessels of the cord when acting upon them in a normal condition, it was thought that it should produce a like effect when the cord vessels were contracted by asphyxia. The experiment confirmed this supposition, for as soon as the animal had its lungs well saturated with nitrous oxide, the cord was seen to expand and the cerebro-spinal fluid began to escape.

We may now briefly consider the conclusions these experiments upon the brain and spinal cord appear to justify. In brain and cord alike, we meet with dilatation of the vessels, with of course an increased blood supply to the nerve-centres. Such a condition would indicate a condition favourable to the dissociation of nervous energy, but this would soon be followed by a condition of over-distension and interference with due regularity of the cerebral and cerebellar circulation subversive of ideation and the performance of adjusted muscular action. The interference to the cord circulation must also interfere with the due con-



duction along its paths as well as with the correlation between its parts and the higher brain centres. At present we may not be in a position to theorise beyond the broad general statements given above, but I think we may justly recognise in the interference with the circulation of the brain and spinal cord, produced by the inhalation of nitrous oxide, a phenomenon which accounts for not only the everyday experience we meet with in giving the gas to human beings, but also to those aberrant cases which occur more rarely, and evince marked nervous exhaustion or irregular outbursts of nervous energy. But of these states I will speak again later on.

The development of nervous symptoms certainly varies largely with the initial state of the nerve protoplasm, for while in some persons nitrous oxide induces marked nerve disturbance, in others it brings about none whatever. I may here be allowed to introduce a brief note upon ankle clonus as revealed under nitrous oxide. This phenomenon is in a certain percentage of cases produced when the patient is deeply under the gas.

Among reflexes it is usual to consider two classes, skin or superficial reflexes, of which a familiar example is found in the conjunctival reflex, and deep, of which we have examples in ankle clonus and the patellar jerk and front tap reaction. In

health, and under normal functional conditions, the superficial and the patellar reflex are present; certain pathological conditions lessen or exaggerate these reflexes, and cause the development of ankle clonus. I think, however, we may take it that the presence of ankle clonus points always to disease or functional derangement of the spinal cord. Now nitrous oxide produces very marked derangement of the reflexes. In October, 1883, Professor Horsley\* drew attention to the persistence of the patellar phenomena under profound anæsthesia, and long after the disappearance of the superficial reflexes. Clonus I have found to be developed in a number of cases, although it is not a constant phenomenon of nitrous oxide narcosis; hence this gas not only abrogates the function of the brain centres, but also produces marked disturbance in the cord, while it blunts or obliterates peripheral sense. What is the exact nature of this derangement of the cord functions we cannot, I think, venture at present to offer an opinion; we can only study it by means of the phenomena it reveals. These also are various, differing, it would appear, according to the stability of the nervous centres of the individual subjected to observation. Nor is this surprising when we remember that the effects are very transitory, and must be largely influenced by

\* "Brain," vol. vi, p. 369 *et seq.*

collateral circumstances. The more constant cord phenomena are—rigidity of the muscles, which passes into complete flaccidity; jactitations which appear rhythmic and general; loss of superficial reflexes; persistence of knee jerk. Among the occasional phenomena we may reckon—ankle clonus; opisthotonus and emprosthotonus; paralysis of the bladder and defæcation centres, and involuntary and unconscious passage of urine and fæces; probably, excitation of the sexual centres, and abolition of the normal checks imposed upon the production of orgasm. Further, we must reckon the secondary results apparently due to a more lasting cord effect, as seen in paresis or even paraplegia following nitrous oxide inhalation. Many of these phenomena are confessedly rare, and are perhaps only elicited in nervous systems predisposed to take on the condition, whatever it may be, which nitrous oxide induces. In some respects nitrous oxide would appear to hold comparison with strychnine. The rigidity, with the occasional liberation of irregular and disorderly explosions of nerve energy, occur, although with different degrees of persistence, alike with one and the other drug. This would perhaps give a clue, and suggest that under nitrous oxide the higher ideomotor centres lose control, the resistances throughout the cord are lessened, and the cells, deprived of the normal restraints imposed by habitual



and associated action, tend to irregular explosive outbursts. It seems at least probable that under nitrous oxide not only do we meet with a stage of preliminary exaltation of function, misdirected indeed, and unconstrained by judgment, in the brain centres, exemplified by the stage of hyperæsthesia spoken of above, but that in the lower cord centres we recognise a similar initial heightening of activity, also irregular and disorderly, followed by cessation of their functionation. Indeed, I venture to think the same sequence of events happens in the vital centres, and that this explains much of what follows in the remarks made upon blood pressure, cardiac, and respiratory rhythm. But although we may not as yet go far enough to dogmatise upon what is the nature of this action upon the cerebro-spinal axis, yet it seems consonant with our facts to regard it as a sedative, which, while provoking an initial exaltation of function, eventually plunges the tissues into a sleep, or state like the long dose of hibernation. Certain it is in some cases one meets with a quiet prolongation of nitrous oxide narcosis, unaccompanied by the wild convulsions of asphyxia, when the breathing absolutely stops while the heart still beats on. In this state presumably the cord centres have gradually yielded, and, the medulla reached, the respiratory centre has also peacefully ceased from work, and the patient is entranced alike in his mental and vegetative

functions. In these cases artificial respiration, conducted for one or two admissions of air, restores the patient to animation, and all goes well. No danger is, in fact, incurred unless the anæsthetist is either incompetent or negligent of his solemn charge. It seems hardly worth while to do more than to beg you to compare mentally these phenomena with those afforded when asphyxia terminates life. To contrast what has just been described with the mental activity persisting almost to the last gasp, the purposeful struggles, the wild chaotic respiratory efforts, the frantic writhings of the voluntary muscles, and at length the general massive convulsions passing into a false quiet marked by an occasional gathering together of the failing nervous energy to effect a spasmodic explosion of muscular force.

Knowing that one of the greatest and gravest dangers which beset the induction of anæsthesia is heart failure, it becomes matter of very great importance for us to determine the behaviour of nitrous oxide towards the heart and vascular system in general. My investigations in this direction have been made to ascertain the action of the heart and the variations of blood pressure under nitrous oxide; and further, to determine how far the variations seen when nitrous oxide was exhibited were due to that body, and how far to the coincident deprivation of oxygen.

The animals selected were dogs and cats, but as the results were practically uniform it is unnecessary to particularise the experiments. I must again admit my great indebtedness to my friends Professor Victor Horsley, Mr. Bradford, and Professor Schäfer, through whose kindness alone the research was practicable.

The heart's action does not become much affected under nitrous oxide, and even in cases in which that gas is pushed until complete cessation of respiratory movements occurs, the heart still continues to beat, its action gradually growing weaker. In no case have I seen any tumultuous action of the heart or a sudden cessation, only the gradual sinking to rest noticed above. The attempt at narcotising animals and timid persons produces a temporary acceleration of heart-beat, but as soon as the intellect becomes under the influence of the narcotic this acceleration passes off and the heart-beats become regular and strong and somewhat slowed. It will be remembered that these results are in accord with the statements already published by me, and based upon numerous sphygmographic tracings taken of the human radial pulse.

The blood pressure under nitrous oxide inhalation has the following peculiarities. For the first period it shows little change ; but subsequently a fall of pressure takes place. Upon allowing the



animal to inhale air, the blood pressure recovers itself, but only gradually, and by passing through a phase of somewhat irregular curves. These curves are not respiratory, as they take place even when the animal is completely paralysed with curare, and artificial respiration is maintained. In some cases a slight, but very slight, rise in the blood pressure took place, but a rise of blood pressure which persists for a notable time appears always to follow the nitrous oxide inhalation. Control experiments were conducted to test the effect upon blood pressure when the animal is deprived of air. These were done upon curarised animals in order to avoid the interference caused by dyspnœic convulsions. As soon as the air supply was cut off, the blood pressure began to go up, and rapidly increased until the heart's action, which lessened in force *pari passu* with the heightened blood pressure, became so weak that it was necessary to allow air to enter the lungs. The blood pressure then resumed its normal height very quickly; but the rise which follows after nitrous oxide administration does not appear to ensue after asphyxia.

It seems to me upon reviewing the nitrous oxide experiments, and controlling them by the asphyxia experiments, that nitrous oxide itself has no very marked influence upon the heart or vessels; that what action it has is to steady and slow the heart, and if anything to strengthen it, and that the

action is somewhat prolonged. The vessels, at first almost unaffected, later on undergo a peripheral dilatation leading to a lowering of blood pressure. This, however, is true only when respiration is made; for, as we shall see later on, the splanchnic vascular areas are contracted at first. Upon this last statement I have some additional evidence to offer. A good-sized frog (*Rana temporaria*) was placed beneath a dome-shaped glass vessel, so arranged that the web of one foot was outside the vessel and could be examined under the microscope. The dome was emptied of air and kept full of nitrous oxide, and the frog carefully noted while the web was examined. It was necessary to keep the whole animal in nitrous oxide as cutaneous respiration is very active in the frog. At first the circulation in the web was found to be slowed; at the same time the minute vessels were seen to dilate, and this slowing and dilatation both became more marked as time went on. Changes also appeared to develop in the corpuscles by which they took on a flattened compressed appearance. At length the respirations, which had become slower and slower, became almost extinguished, the capillary circulation in some areas was almost in a condition of stasis, whilst throughout the field extreme slowing had occurred. At this point the frog was allowed free access to air, and at once the respiration

quickenened, the blood flow increased in rapidity, becoming many times more rapid than under the gas. The corpuscles resumed this normal aspect. The results of such experiments upon the frog point to a peripheral dilatation of capillaries, and of this further evidence has yet to be adduced. It needs no argument to show that a vascular viscus, like either the kidney or the spleen, must under variations of blood supply undergo variations in size. If, therefore, it were possible to enclose either viscus in an air-tight receiver communicating with an oil manometer, it would give indications of increase or diminution of size according as the blood supply were increased or lessened. Mr. Bradford has kindly enabled me to investigate this point pretty fully.

The experiments made upon the kidney were tolerably numerous, and were singularly uniform in their results. The kidney in an animal narcotised with nitrous oxide speedily undergoes contraction, which corresponds of course with the contraction of the renal arteries. This contraction continues as long as the nitrous oxide is given, but as soon as that is cut off and the animal respire air the kidney speedily recovers its normal size, but no dilatation of vessels beyond normal takes place. With this condition we have to compare the behaviour of the kidney in an animal subjected to asphyxia. Here the kidney undergoes a dilata-



tion as soon as air is cut off. This corresponds with dilatation of the renal arteries, and is probably due to increased heart action called into being by the venosity of the blood. Later on, when the heart fails, the kidney suddenly contracts, a very rapid fall in the kidney curve occurring. Thus a singularly striking contrast in the behaviour of the kidney reveals itself according as that viscus is influenced by nitrous oxide or asphyxia. This effect upon the renal circulation must not be taken as militating against the statements made above with regard to the general blood pressure as shown by the carotid artery and about the circulation in the brain and cord. It is well known that certain sedatives—morphine, for example—dilate the vessels in one area while they contract those of other areas.

Passing to the effects produced by nitrous oxide upon respiratory rhythm, I will detain you only a few moments.

The chest movement will, as is well known, continue without any air entering if a sufficiently long and small elastic tube be attached to the tracheal canula, so that one can easily compare asphyxia with nitrous oxide narcosis. In the last condition the respirations are at first quickened, but not lessened in depth; later on they grow slower and deeper, and still later they become very slow and somewhat more shallow; finally they

cease. The time in which this cessation comes about varies considerably in animals. I have not seen the dyspnœic struggles under nitrous oxide which asphyxia brings about. In human beings I have seen, especially in children, complete cessation of respiration without the slightest preliminary struggle. Alike in the lower animals and man the breathing recommences if pressure is made on the chest. These changes in respiration are, I am inclined to think, due wholly to the action of nitrous oxide upon the nerve centres presiding over respiration.

In conclusion, there are various practical considerations which I think may well be taken into review while studying the physiology of nitrous oxide narcosis.

If, as I submit, nitrous oxide acts as a sedative in virtue of its own inherent properties, and does not owe its value as an anæsthetic to asphyxial processes called into play by concurrent privation of oxygen, it should be our aim to push the gas and give free vent to expired gas. We should see that our patient changes as freely as possible his residual air during inspiration, and expires as freely as possible the refuse-laden nitrous oxide which has been stationary within the air-spaces during the last respiration. I cannot but think that, whatever may be the saving of gas brought about by employing supplemental bags wherein the nitrous

oxide is collected and re-inspired again and again, the patient suffers by their use from the double evil of breathing diluted and impure nitrous oxide, and further, is not favourably placed for exhaling the refuse of the lungs. I should incline to attribute to this method the cases one occasionally meets with of severe headache, vertigo, dizziness, and other untoward symptoms consecutive upon nitrous oxide inhalation. It is, I believe, a very important point to induce very free inspirations of *pure* nitrous oxide, and to avoid anything like inducing partial asphyxia, and I think in practice this gives the best and the most satisfactory results.

The behaviour of the heart under nitrous oxide should, I take it, encourage us to use this agent freely, and during its administration to watch rather the respiration than the pulse; since it would appear that syncope, if it occurs, occurs secondarily through the lulling to sleep of the respiratory centres. The cases in which nitrous oxide has been said to kill by heart failure are few, and even in these we are not at all sure that the fatal faint was not due to fear or shock incurred by a nervous system already shaken by suffering, and rendered still more obnoxious to shock by an imperfect narcosis. When we remember the period of heightened sensibility which precedes complete restitution of consciousness, we can easily comprehend the terrible jars a debilitated nervous



system must sustain if operative procedure be carried on into this stage. Clover long ago pointed out from his vast clinical experience that patients may be allowed to cease breathing, and yet no fear need be entertained, as a few vigorous pressures upon the thoracic parietes will re-initiate respirations. Now we accept his statement, and explain it under physiological laws.

There are other practical points that are suggested by knowledge of the action of nitrous oxide. Of these not the least important is that the erotism called into existence in a fairly large proportion of patients, and controlled only in a few by the restraints of habitual thought and judgment, should render all persons most careful to avoid possible incrimination through hallucination. For the sake alike of patient and operator a witness should always be within earshot or within sight whenever nitrous oxide is administered.

Again, the decided action this anæsthetic has upon the nerve centres, and its tendency to call forth irregular explosions of nervous energy might by some be taken as contra-indicatory to its employment for patients who are the subjects of epileptiform seizures. I do not, however, think we can with justice say that the giving the gas renders a fit more likely to occur than the operation. We are aware any strong excitant will call forth a seizure, whereas the sedative action

of the nitrous oxide will by lessening stimulation from without, be less inclined to provoke the attack.

There is one further remark I would make, and that is concerning the late M. Paul Bert's method of giving nitrous oxide under pressure. I may say that my reason for giving only a passing notice to what must appear to many of you, as a method, in the last degree important. Fully admitting the immense value in theory of Bert's method, I am bound to confess to myself that it at present needs far too much machinery and elaboration for practical work-a-day men like ourselves. Indeed this view appears to be held even in Paris, where a Fontaine's chamber is accessible, for I hear from a correspondent that no cases of operation have of late been conducted by this method.

In conclusion, I have to thank this Society for its courtesy towards myself. The Odontological Society has done more than any other body to elucidate the action of nitrous oxide, and hence it was but fitting that my research should see the light in that Society, and this has been permitted me through the courtesy of two generations of Secretaries.

## DISCUSSION.

The CHAIRMAN said they were greatly indebted to Dr. Buxton for the amount of original research which he had brought to bear upon a very interesting and important subject. He was sorry to see that so short a time remained for discussion, and he would therefore ask intending speakers to condense their remarks as much as possible.

MR. WOODHOUSE BRAINE said the question, "In what way does nitrous oxide produce insensibility?" though often asked, had not as yet been satisfactorily settled. He wished that evening to bring forward a new theory, and would do so in as few words as possible; still he thought it better to proceed slowly, step by step, so as to save time in the end. He would say at once that he was inclined to believe that nitrous oxide anæsthesia was produced by increased brain pressure. To begin from the beginning. It was well known that light and heat had been conclusively proved to consist simply of molecular motion. When the former impinged on the sensitive retina, and the latter on any cuticular surface, both were immediately recognised; the most simple explanation of this being felt was by the assumption that the particular molecular motion was continued along the nerve trunks to the brain, where the cerebrum recognised the motion, in the one case as light, and in the other as heat.

Going one step further, it was also known that special nerves only transmitted special sensation. Thus the optic nerve only transmitted the sensation of light; a given number of vibrations sent along the nerve giving the impression of a red colour, whilst others, varying in number and amplitude, produced the various shades of blue and yellow. So again with respect to the auditory nerve; let a given number of vibrations be sent through the air, and a scientist knew to a



certainly what particular musical note would be perceived. It was no doubt in a precisely similar manner that the nerves of taste, by means of the rapidity and amplitude of their vibrations, enabled us to distinguish the flavour of what was placed on the tongue.

To take another step. When the nerve filaments of these special nerves were made to vibrate in any way whatever, if the rate of vibration set up was the same as that which produced a special sensation, the cerebrum received the impression of that sensation, whatever it might be. Thus a blow on the eye produced the sensation of a flash of light, and when the nerve filaments of the tongue were thrown into a state of vibration by a galvanic current the sense of taste was produced. But if this motion was checked in any part of its course the sensation it usually produced was not perceived. Thus if a part was frozen by ice or ether spray the nerves were rendered rigid and incapable of transmitting vibrations, and no sensation was felt when the part was operated on, a fact which was taken advantage of in the present day to lessen the pain of an operation, whilst in the olden days of surgery we read that the pain of an amputation was lessened by making pressure on the nerve trunks which supplied the part to be operated on.

The same result followed when the pressure was not applied to a nerve, but directly to the brain itself. Thus in the case of a slight attack of apoplexy a blood vessel gives way and makes pressure on the cerebral tissue in its immediate vicinity, and paralysis and loss of sensation occur in those parts of the body to which the nerves of that particular part of the body proceed. Again, a blow over the anterior inferior angle of the parietal bone might cause laceration of the middle meningeal artery, and if the blood was slowly poured out, insensibility did not supervene for some hours, or until there was made sufficient pressure on the brain. But when sufficient pressure was made on the cerebral matter the patient became completely insensible, and remained so until the blood was absorbed, or until the surgeon relieved the pressure by trephining.

Now to come to the part of Dr. Buxton's paper to which he wished to call special attention, and which, he thought, gave the clue to the reason why insensibility followed the administration of nitrous oxide. In the case of the dog he mentioned, which had been trephined and then had nitrous oxide administered, the brain substance was seen to swell until the pressure from within was so great that it absolutely protruded from the brain case through the hole made by the trephine. He thought it was only fair to infer that a corresponding enlargement of the brain substance took place in the case of the human patient when put under the influence of nitrous oxide, the cerebral tissue swelling until the pressure against the cranial walls was sufficient to produce insensibility; and all parts of the brain being pressed on alike, the insensibility was not partial, as in one of the cases he had mentioned, but total and general.

In conclusion, it was scarcely necessary for him to say how much indebted he felt to Dr. Buxton for his very interesting paper.

MR. BAILEY said he felt sure that all present were much pleased with Dr. Buxton's paper, and their thanks were due to him for bringing the subject forward in so able a manner. It would, however, have been more easy to follow some portions of the paper if he had tabulated the effects of nitrous oxide. As a practical man he could positively state that all the symptoms met with during the administration of nitrous oxide were certainly not due to asphyxia. In the course of three or four respirations the carbolic acid was cleared from the lungs, the nitrous oxide got into the blood, and from some cause or other a state of insensibility was produced. Whether this was due or not to pressure on the brain he must leave others to determine by experiment, though he could scarcely have conceived that the pressure on the brain could be so great as it appeared to be from what Dr. Buxton had stated; but there could be no doubt that the effect of administering the gas was to produce a condition of insensibility to pain.

With regard to the practical question as to the best method of giving the gas, his own practice was to give the patient a free flow of gas with an open expiratory valve, doing away as much as possible with the supplemental bag. Of course this plan was not as economical as the other,—he found that on an average each patient took about seven gallons of gas,—and no doubt the experiments of Mr. Coleman and of Mr. Clover showed that after a few respirations nearly pure nitrous oxide was expired; still his experience was that by giving the patients a free supply of pure gas a more perfect anæsthesia was produced.

Was it a fact that fatal results might result from giving the gas? In all his experience he had only had three cases in which ill effects were produced by it. In two of these the patient simply ceased to breathe, and had he not at once resorted to artificial respiration, he would, he feared, have lost his patients. The other patient was a girl who, three or four days after taking the gas, got into a sort of nervous condition which caused her to wander about in a purposeless manner, and for a time she appeared to be really very ill. This was an effect which, he confessed, he did not understand; but the broad result was that when the patient obtained pure gas no ill results followed, except in an almost infinitesimal proportion of cases, and he felt perfectly convinced that the symptoms observed were not due to asphyxia, and that, in fact, asphyxia had little or nothing to do with them.

PROFESSOR V. HORSLEY said he was very glad to hear from Mr. Braine that the results of his practical experience had been to convince him that the effects of the administration of nitrous oxide was not due to asphyxia, but rather to some special toxic action. Dr. Buxton's experiments, as well as those of others who had gone before him, had, he thought, plainly demonstrated this fact. With regard to Mr. Braine's suggestion that the effects of the gas were produced by mechanical means, this could easily be proved or disproved by a single experiment. The removal of the upper part of



the cranium in an animal was not an operation of any great difficulty or danger to life, and if this were done to an animal which had been anæsthetised by the gas, the animal, if Mr. Braine's hypothesis was correct, would at once recover consciousness, and it would be impossible to anæsthetise it further. He thought, however, that the result of the experiment would be to show that the gas did not act in the mechanical manner which had been suggested. But this was an assumption which perhaps he had no right to make, but should rather wait until Mr. Braine had performed the experiment, though it seemed to him that Dr. Buxton had almost exhausted the subject from an experimental point of view.

DR. FREDERIC HEWITT said he felt that Dr. Buxton had deservedly earned the thanks of the Society for his able and interesting paper. The time for discussion was short, but he would like to make a few remarks. With regard to the circulatory changes during nitrous oxide narcosis, he had found, by the observation of a considerable number of cases, that the pulse was usually reduced in volume and increased in frequency. In many instances the radial pulse became almost or quite imperceptible towards the end of the administration; whilst the sudden transition to a full and slow pulse directly a breath of air was inhaled after the removal of the face-pieec was a marked and usually constant feature of the administration. He thought that there was still room for inquiry concerning the condition of the systemic venous system during the inhalation of nitrous oxide. It seemed probable that considerable venous engorgement occurred, as Dr. George Johnson believed; but, as this condition would ensue in asphyxial states, and as the line of demarcation between nitrous oxide narcosis and asphyxia was, in our usual modes of administering the gas, hardly capable of definition, it became a difficult matter to know how far the circulatory changes of nitrous oxide narcosis, when the anæsthetic was administered by the methods commonly in use, were to be explained by the absence of oxygen, which necessarily

existed. That the phenomena of nitrous oxide narcosis were not entirely due to asphyxia Dr. Buxton had shown; indeed the very fact of our being able to induce the state of general anæsthesia by nitrous oxide in the presence of oxygen, as by Bert's method, was sufficient to establish this fact. There could be no doubt that, in ordinary methods of administering nitrous oxide, the oxygen present in the respiratory passages, as well as the oxygen of the circulating blood, became *rapidly* displaced; and he (Dr. Hewitt) therefore ventured to point out that due allowance should be made for this fact when comparing the displacement of oxygen by means of nitrous oxide with the more tardy disappearance of the oxygen in many of the asphyxial conditions to which Dr. Buxton had compared nitrous oxide narcosis.

With regard to the respiratory phenomena which characterised the administration of nitrous oxide to human beings, he had observed a peculiar sequence of events in most cases which he had met with. If the finger were placed upon the larynx throughout the administration, and if the inhalation were carried to its fullest extent, the following movements of the larynx would usually be detected. As the respiratory acts became deeper, the larynx would be found to descend more and more with each inspiration. This appeared to be due to the condition of hyperpnœa, in which the sudden and forcible chest expansions tended to draw the larynx and trachea towards the thorax. During the later stages of the administration, however, that is to say, when all or most of the signs of anæsthesia had become established, the larynx would be found, in most instances, to be moving as in the act of swallowing. In consequence of these movements, respiration became somewhat jerky, as no passage of nitrous oxide could, of course, take place through the glottis during the first stage of deglutition when the epiglottis was in contact with the superior aperture of the larynx. If the anæsthetic were pushed, respiration actually ceased, but the cessation was due to this obstructive condition, the larynx remaining drawn up, as in the first stage of deglutition, apparently by the muscles usually employed

for the purpose. Dr. Buchanan had expressed his belief that the thyro-hyoid muscle was the one which pulled up the larynx behind the hyoid bone, and it was probably this muscle, aided by the other elevators of the hyoid bone and larynx, which was the cause of the alteration in the respiratory rhythm which was so commonly met with at the close of an administration.

These movements of the larynx frequently manifested themselves in conjunction with the clonic and tonic muscular contractions which were so familiar to the administrator of nitrous oxide. How far they were to be regarded as dependent upon the same causes as the muscular contractions of the extremities he would not say. His own impression was that all the tonic and clonic phenomena of nitrous oxide narcosis should be regarded as epileptic in origin, using the word epileptic in its widest sense, as suggested by Professor Horsley in his lectures on Epilepsy. Further than this, it seemed to him that the movements of deglutition to which he had referred were, in a way, preservative to the patient, and accounted for the great safety of the anæsthetic. The careful observation of cases had led him to the conclusion that the embarrassment to respiration which characterised the administration of nitrous oxide carried to its fullest extent, was in reality due to the form of obstruction he had described. If the face-piece was not removed when symptoms occur, respiration would refuse to proceed.

There was one other point in connection with this matter. It was known that pulling forward the tongue in cases of respiratory failure under nitrous oxide was often successful in re-establishing breathing. Now, when the epiglottis has been allowed to come into close apposition with the superior aperture of the larynx, by reason of the persistence of the first stage of deglutition, it was probable that by forcibly pulling forward the tongue, the epiglottis would be dislodged from its dangerous position. Looking at the matter from a theoretical point of view, it seemed to him probable, that amongst the discharges of nervous energy which were to be observed in most cases of nitrous oxide narcosis, impulses



from the deglutition centre in the medulla were transmitted to the muscles involved in the mechanism of swallowing. Nervous discharges of a local nature were to be observed in some varieties of epilepsy. For example, laryngeal spasm, with carpo-pedal contractions, often characterised the epileptic condition termed "laryngismus stridulus." In some cases of this affection the epileptic phenomena were restricted to the larynx; in others, the feet and hands participated; whilst in a remaining group of cases the whole body became convulsed. He did not deny that respiration might cease from other causes than that to which he had referred. There was no invariable rule with regard to the sequence of the epileptic phenomena of nitrous oxide; sometimes tonic spasm was alone present; sometimes clonic movements were alone developed; in other cases tonic contractions preceded tonic, or *vice versâ*.

The tonic-clonic sequence which Professor Horsley had ascribed to discharges from the cortex of the brain was certainly not always present. Indeed there were many reasons for supposing the discharges to be of bulbo-spinal origin in the majority of cases. The actual cause of these phenomena was at the present time surrounded by much doubt. So far as he knew, they were rarely, or not at all, developed in Bert's method of inducing narcosis with nitrous oxide and oxygen under increased pressure. He could not help thinking that they depended in some way, at present unknown, upon an asphyxial state of the blood. Although Dr. Buxton had said that he had never seen anything like the convulsions of asphyxia—expiratory convulsions—during nitrous oxide narcosis, he (Dr. Hewitt) thought that it was very difficult to prove that the epileptic phenomena of nitrous oxide were totally independent of want of oxygen. It was true that they were unlike the expiratory convulsions of asphyxia; but they might still be modified asphyxial symptoms—modified by the different vascular conditions of the two states, by the presence of nitrous oxide, or by other factors of which we know very little. He thought that the study of this particular branch of the subject might reveal many interesting facts.

Lastly, he would add a few words concerning the practical aspect of the nitrous oxide question. Here he felt himself totally unable to agree with Dr. Buxton's remarks. He was of course aware of the serious disadvantages of allowing a patient to inhale, from the commencement of the administration, a limited volume of nitrous oxide over and over again; and he wished distinctly to say that he had never advocated such a method. The lungs should *always* be first washed out, as it were, by pure nitrous oxide; and then, in his opinion, it was of great advantage to allow the patient to take a certain number of to-and-fro respirations, the lungs having by this time become almost entirely free from residual air. He had had three years' experience of the method he advocated, and had published the results which he had obtained. The advantages of this method of administration over the "open" method—that in which every expiration from first to last was allowed to escape—were briefly these:—The period of anæsthesia was undoubtedly prolonged, and the nature of the narcosis was very satisfactory; whilst, in consequence of a smaller volume of gas being required, the apparatus for the administration was rendered extremely portable. He had never met with any unpleasant effects which could be attributed to this method. That the period of resulting anæsthesia was longer than that obtained by the "open" method he had shown in a recent communication to one of the Journals; and, if the Society would allow him, he would mention the case. Emily Yates, *æt.* twenty-two years, healthy in appearance, and with no abnormal thoracic condition, presented herself on six occasions as a gas patient at the Dental Hospital. On three of these he administered nitrous oxide by the "open" method; the average length of inhalation was 53 seconds, the average length of anæsthesia after the removal of the face-piece was 39 seconds. On the other three occasions he administered nitrous oxide by what might be termed the "open-close" method (that is to say, allowing the patient to breathe gas out at an expiratory valve till anæsthesia was nearly complete, and then closing the expiratory valve and allowing to-and-fro inhalation for the

remaining short period of the administration). The average length of inhalation by this method was 84 seconds, whilst the average length of anæsthesia after the removal of the face-piece was 56 seconds, thus showing that by the second method the anæsthesia had been longer than by the first by 17 seconds. In each administration the gas was pushed to its full extent, and by the kindness of several gentlemen the times were taken as accurately as the circumstances would allow. It would be seen from these figures that the patient was able to respire longer by the "open-close" method than by the purely "open" method. This could be explained readily. A very small amount of oxygen from the residual air remained in the current of gases for a longer period when a little to-and-fro inhalation was permitted, and hence respiration continued for a longer period. The explanation of the longer anæsthesia was also not far to seek. Within certain limits, and other things being equal, the more nitrous oxide the patient could take up, the longer would it take for its elimination to occur, and hence the longer would he remain unconscious. This was often seen in ether or chloroform narcosis, analogous in many respects to that of nitrous oxide. The objection which Dr. Buxton had mentioned concerning the to-and-fro respiration of nitrous oxide, viz., that carbonic anhydride and other effete respiratory products remained in the lungs, was hardly to be regarded as of importance. He (Dr. Hewitt) had shown by analysing the contents of the bag after 8 to-and-fro respirations—the lungs having previously been washed out by 25 respirations of pure gas—that the percentage of carbonic anhydride did not exceed .64. With respect to the other respiratory impurities he could only say that they could hardly exert any prejudicial effect when the administration was conducted in the manner he suggested, for it was not necessary that many to-and-fro respirations should be taken, and as he had before said, he had never known the slightest unpleasantness from the method described.

In conclusion, he would offer his best thanks to Dr. Buxton for his interesting paper. The questions raised



were of great difficulty in the present state of our knowledge of the functions of the nervous system; and until physiology had taught us more concerning this and other collateral subjects, it was not likely that the precise mode of action of nitrous oxide would be capable of definition.

The CHAIRMAN said he was very sorry to be obliged to put a stop to the discussion, but as it was past the usual hour for adjourning the meeting, he must call upon Dr. Buxton for his reply.

DR. BUXTON said it would be quite impossible for him at that late hour to reply to all that had been said by the various speakers; still he was glad of the opportunity of saying a few words.

He could not help admiring the ingenuity of Mr. Braine's theory, though he did not think it would be found to stand the test of experiment. He did not believe that the brain ever actually filled up the brain case, and if it did very different results would be produced from those which did occur. He hoped, however, to have an opportunity of trying the experiment suggested by Professor Horsley.

Although it was rather difficult to prove by experiment the superiority of one method over the other, he preferred to employ the "open" method instead of the supplemental bag. He had read in one of the Journals the experiments referred to by Dr. Hewitt, but he could not consider these conclusive. They were open to several sources of fallacy. In the first place a great deal depended upon the quality of the gas. He believed that at the Dental Hospital the gas was made freshly from week to week, if not from day to day, and his experience was that its quality varied very much indeed, depending apparently upon who made it, or on the amount of care and attention bestowed upon its manufacture.

He was anxious to take the opportunity of expressing his regret for having in his former communication misquoted Mr. Alfred Coleman. He had relied upon an abstract of Mr. Coleman's paper which turned out to be unreliable. He wished also to say that he entertained the highest opinion of

Mr. Coleman's excellent and trustworthy experiments upon nitrous oxide gas,—experiments which were, however, so widely known and so universally esteemed as to make any praise from him (Dr. Buxton) superfluous.

In conclusion he thanked the members for the patience with which they had listened to so long a paper.

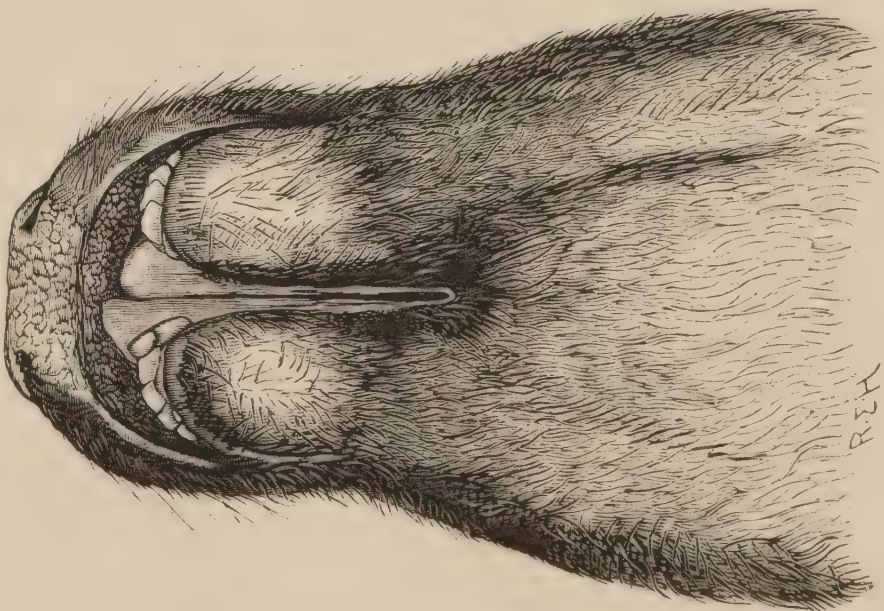
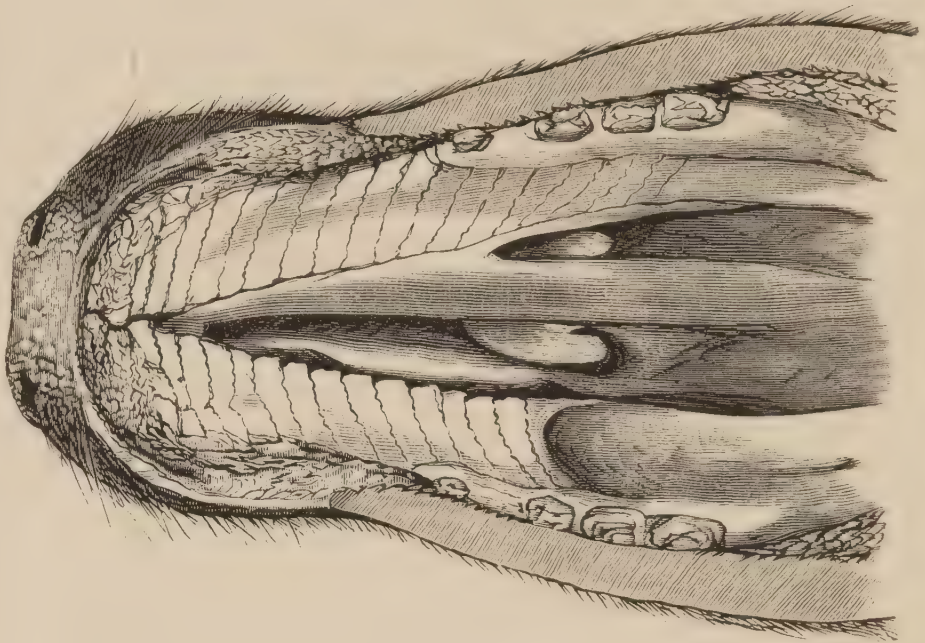
The CHAIRMAN thanked Dr. Buxton, in the name of the Society, for the very interesting and comprehensive paper with which he had favoured them, and also the gentlemen who had offered remarks on the subject. He would also again express their indebtedness to Mr. Winterbottom.

The Society then adjourned.









MR. HUMPHREYS' SPECIMEN OF CLEFT PALATE, &C., IN A CALF.  
For description see p. 141.

# Odontological Society of Great Britain.

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## ORDINARY MONTHLY MEETING.

*April 4th, 1887.*

CHAS. S. TOMES, F.R.S., PRESIDENT, IN THE CHAIR.

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THE Minutes of the previous meeting having been read and confirmed,

MR. DANIEL BROWNING signed the Obligation Book, and was formally admitted to membership by the President.

THE PRESIDENT announced that MR. JOHN TRUDE FRIPP, of Willesden, had been duly nominated as a candidate for membership, and would be balloted for at a subsequent meeting.

THE PRESIDENT announced that it was suggested by the Council that Mr. J. Bland Sutton and Dr. Dudley W. Buxton, both of whom had read valuable papers before the Society, should be elected Honorary Members, and that this proposition would be put to the vote at a subsequent meeting.

MR. FRANK H. KISSACK, L.D.S.Eng., 17, Bentinck Street, Manchester Square, was then balloted for, and elected a Resident Member of the Society.

THE CURATOR announced the following additions to the Museum:—The skulls of the Negro Tamarin (*Midas ursulas*), Common Paradoxure (*Paradoxurus typus*), Common Otter (*Lutra vulgaris*), Common Seal (*Phoca vitulina*), Collared Peccary (*Dicotyles tajacu*), Beaver (*Castor canadensis*),



Crested Agouti (*Dasyprocta cristata*), and the lower jaw of a Sea Otter (*Enhydra lutris*), had been acquired by purchase; whilst they were indebted to the Zoological Society of London for the gift of the skull of a young deer (*Cervus schomburgii*), in which the teeth and alveoli were extensively affected with disease. He hoped to be able to describe this specimen more fully on a future occasion.

DR. W. HARRISON, of Brighton, showed a model of an unusual case of double hare-lip. The patient, a boy five weeks old, was admitted into the Alexandra Hospital for Children, at Brighton, under the care of Dr. Whittle. The pre-maxillary bone was firmly attached to the septum of the nose, and occupied a very prominent position, the columella being at the tip of the nose. There was an unusually wide gap in the lip, but no opening in the palate, simply a slight depression. Dr. Whittle removed the premaxillary bone, and drew the sides of the cleft together, including, or rather utilising, the columella. The result was that, whereas the nostrils had been previously extremely wide, they were now somewhat unduly pinched, and the lip had not the support of the maxillary process of the upper jaw. The child was discharged well, but was re-admitted about five weeks later, suffering from an acute attack of diarrhoea, which proved fatal within forty-eight hours.

MR. W. PENFOLD showed and presented to the Museum a case of instruments which were exact copies of some which had been found at Pompeii, and were preserved in the Museum at Naples, where they were labelled "Dental Instruments." Mr. Penfold remarked that they did not in the least resemble any instruments now in use in the profession, and he much doubted whether they were correctly described by the Museum authorities. He thought it much more probable that they had been used for modelling clay or for enamel work.

MR. S. J. HUTCHINSON remarked that when he visited the Naples Museum, in 1878, there were no dental instruments, even so-called, to be seen, though he had searched for them.

DR. ST. GEORGE ELLIOTT showed a modification which he had made in the Hodge right angle attachment. Those who had used this instrument must be aware of its one defect, that of not holding the bits securely, particularly when the instrument is a little worn, owing to the screw slightly loosening. The modification he had made consisted in attaching to the cover of the screw the lock-pin of the early S.S. White right angle. This completely overcame the defect, but introduced a fresh difficulty of minor importance,—the bits must be properly made, or the lock-pin would not close.

He had hoped to have been able to show also a model of a hot-air engine, but the maker had disappointed him. These machines could be used for running the dental engine, but were not sufficiently powerful for general laboratory work.

MR. ACKERY showed a pair of forceps for the division of lower molar stumps, which had been designed by Mr. Rowney, of Derby. On the inside of the blades was a projecting shoulder, to prevent them from slipping further down than was desirable.

Mr. Ackery also read the following notes of an obscure case of disease of the upper jaw, attended with abscess of the cheek and salivary fistula, &c., and cured after five years' duration by the extraction of two upper molars:—

“Mr. President and Gentlemen,

“The case I propose to bring before you this evening is one of serious trouble in the upper jaw, which for a long time seemed independent of the teeth, but which, until the removal of the left upper molars, obstinately resisted treatment. I should like to have the opinions of the members of this Society on the case, as I think there is sometimes a tendency with us to describe cases as *dependent* on dental irritation which would, on careful investigation, equally well admit of another explanation.

“The patient, a medical student, aged twenty-six, was sent to me by Mr. Thomas Smith on 20th September, 1886, and I will read you the notes of his condition at that time.

“*Present Condition.*—On the left side of the face there is a slightly swelled condition of the soft tissues, accompanied by thickening and induration of the cheek, in the centre of which is a conical, soft, fluctuating tumour, about the size of a Barcelona nut, over which the skin is very much thinned, and seems in immediate danger of breaking. The jaw cannot be opened more than enough to admit the tip of the little finger between the incisor teeth.

“The substance of the cheek is much thickened, the mucous membrane on its inner surface is of a dusky red colour, and the gum on the alveolar and palatine portion of the jaw on that side is distinctly deeper in colour than normal, and of a soft, puffy character. There is a sinus, above and between the apices of the bicuspid roots, on the buccal side of the alveolus. (I passed a probe into this sinus, which ran backwards and inwards for some distance, but I did not at this time detect the presence of dead bone.) The teeth on this side are all present and free from caries, but the third molar is only half erupted, with its crown pointing outwards towards the cheek. None of the teeth are tender on percussion.

“The following *Previous History* was elicited from the patient, to whom I am indebted for a careful *résumé* of his case, from which I quote.

“Six years ago, during the winter of 1880–81, had pleurisy with effusion three times in rapid succession, the illness in the first instance being attributed to getting wet through at football.

“On 7th July was so far recovered that he was ordered change of air, and by advice went a sea trip to the Mediterranean, deriving great benefit and gaining in strength and weight. Whilst crossing from Malta to Marseilles he encountered heavy weather, but remained on the deck all day. On arriving at Marseilles, about the middle of August, he found, for the first time, that his face was a little swollen on the left side, but feeling well in himself, and having no pain, he stayed a week sight-seeing in that town.

“On 23rd August he began to feel out of sorts, and the



face becoming painful he started for home, reaching Paris on 24th, the pain getting better just before his arrival. On examining his mouth he found that an abscess had burst just above the left canine. He reached London on 30th August, feeling quite well again.

“From this time till April, 1886, a period of nearly five years, pus collected at varying intervals, and was from time to time evacuated by incisions in the neighbourhood of the canine tooth. During all this time he suffered little or no pain.

“From time to time he sought advice, but, though suspected and searched for, dead bone was never detected with the probe, and he was advised to wait, as the surgeons saw no indications for interference.

“In April he broke down again through overwork and a slight attack of rheumatic fever. The abscess during April and May continued discharging freely, and in July the face swelled again, although he had no pain. By the end of the month the swelling and discharge had quite subsided. About this time the patient noticed that he was cutting the left upper wisdom tooth.

“In the middle of August a small hard lump, about the size of a threepenny piece, with a smooth rounded surface, appeared below the antrum and above the second molar. This lump rapidly approached the surface of the cheek, but was perfectly painless. Fearing that the abscess would burst externally the patient made an incision inside the cheek, a free discharge of pus taking place.

“In the middle of September he consulted Mr. Thos. Smith, who sent him to me, saying he thought he could feel a stump behind the second molar. The notes I made on the case on this occasion I have already read.

“I could not at this time trace any *dental cause* for the disturbance, and could not advise the removal of any teeth as likely to cure the existing condition of affairs, but I was of opinion that the wisdom tooth would be better away, as it was irritating the cheek, and *might possibly* be at the bottom of the mischief. I saw Mr. Smith the same day and suggested

that the sinuses should be explored. In this Mr. Smith concurred, and on 22nd, the patient being placed under chloroform, Mr. Smith forced a director into the anterior opening and at once came down on dead bone (probably the anterior wall of the antrum), which, however, was not loose. The sinus was laid freely open and plugged with lint, and the patient put to bed. Two days after this the patient was allowed to return home, and he continued to plug the wound for himself. In a short time (about twenty-one days) he began to find difficulty in opening the mouth, and could no longer feel dead bone with the probe. On 27th October another abscess burst into the mouth behind the molar teeth, the stiffness of the jaw being at once relieved. A probe passed into this newly formed sinus came upon dead bone. The abscess in the cheek now became very painful, and during the first week in November, when away from town, he had it opened externally, some very foul pus being evacuated. The discharge about this time became very copious and watery, especially when food was taken into the mouth. The wisdom tooth was now pressing against the swollen cheek and causing ulceration, and at Mr. Smith's request he saw me again on 19th November. I then removed the wisdom tooth, which showed only slight congestion of the anterior surface of the extreme apex of the fang. On this occasion I also found a small soft swelling on the palatine side of the *first molar*. This I incised, and at once came down on what proved to be the palatine root of the first molar. The wound was plugged with lint. On 25th November the first molar was found to be loose, and somewhat tender on percussion, the whole length of its palatine root being bare. I removed the tooth and found the whole space between its three roots filled with firmly matted inflammatory tissue, all traces of a bony septum being wanting. The socket, which was formed by rough carious bone, was plugged with lint soaked with aromatic sulphuric acid, and was daily dressed by the patient in the same way. On 1st December the anterior root of the second molar was exposed in the wound, and on the 10th bare bone could be felt *around* the roots, whilst *between* them

the same tough inflammatory material presented. This tooth was removed, with the above soft tissue which was firmly adherent to the roots on all sides. The aromatic sulphuric acid dressing was persevered with by the patient until the first week in January, when, as no rough bone was felt, simple lint was packed into the cavity in order to ensure its granulating from the bottom.

“By the end of the month the wound in the mouth had nearly healed, and the salivary discharge from the *external* wound had ceased. The cheek was still very much thickened, and of the same deep colour as before. The abscess on the cheek discharged very little, but the skin over an area about the size of a shilling was not adherent to the subjacent tissues. I scraped the adjoining surfaces of this pouch with a sharp, spoon-shaped excavator, and attempted to keep them in contact by a pad of lint held in place with strapping. A week afterwards there was very little improvement, the skin being still non-adherent, and it was evident that the present contrivance for keeping the surfaces in contact was not very satisfactory, as owing to the movement of the cheek in speaking and eating the strapping soon worked loose. A small piece of solid nitrate of silver was inserted into the sac, and as far as practicable applied to both surfaces; lint and strapping being applied as before. In the course of a few days a Steno's duct compressor was procured, and after the surfaces had been again refreshed with the excavator, a pad of lint was placed over the wound and the compressor adjusted. The pressure at first was rather painful, but the patient managed to wear the instrument without much discomfort for a week, at the end of which time (February 26th) the non-adherent surface of skin was reduced to the size of a sixpence. The surfaces were again refreshed and the pressure applied.

“There is no history of syphilis, but although the patient has shown no previous symptoms of struma, several members of his family have the strumous diathesis fairly well marked.

“I saw the patient again on Friday last (March 4th). The wound in the mouth has entirely healed, with the exception



of a rather deep sinus leading upwards from about the centre of the position originally occupied by the second molar. No dead bone or rough surface could, however, be felt with a probe. The action of the compressor on the external wound has been very satisfactory, and only just the callous edges in the line of incision remain ununited. The substance of the cheek has resumed its normal condition.

“The main point of interest in this case centres in the question, What was the origin of the mischief?

“Were the teeth, or any of them, the cause of the trouble, or were they only subsequently involved? Was the case one of caries of the jaw, of idiopathic origin, or was it consequent upon the inflammatory disease (pleurisy) in the same way that we not unfrequently find necrosis after the exanthemata, or was it the result of exposure to cold on board ship during the passage from Malta to Marseilles, at which time the first symptom was noticed? It is upon these points that I should like to hear the opinions of members who have had longer and more varied experience.

“The treatment of the carious surface with aromatic sulphuric acid was suggested by the successful use of that agent in *Pyorrhœa Alveolaris*.”

MR. C. V. COTTERELL showed models of the mouth of a youth, aged eighteen, whose teeth were dark yellow in colour, and so soft that they could be cut with a knife. He had enjoyed good health, with the exception of a severe attack of dysentery when about a year old; could this illness have had anything to do with the state of the teeth? It should be mentioned, however, that a paternal uncle had very similar teeth.

MR. D. HEPBURN remarked that he had seen one case in which the prolonged use of acids, prescribed medically, had caused complete decalcification of the teeth.

The PRESIDENT inquired whether anything was known of the treatment to which this patient had been subjected for the dysentery?

MR. COTTERELL replied in the negative.

DR. WALKER showed, for Mr. Humphreys of Birmingham, the head of a calf with cleft palate extending the whole length of the roof of the mouth. The halves of the lower maxilla were ununited, with an extra incisor in the left half, without any bony attachment. The tongue was also bifurcated for some distance. The animal, which was otherwise strong and well formed, was killed when five days old. Owing to the want of union between the two portions of the lower jaw, the ordinary grinding movements of ruminants would have been impossible.

The PRESIDENT then called upon Mr. F. N. Pedley to read his paper on "The Pathology of Riggs' Disease, or Pyorrhœa Alveolaris."

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*On the Pathology of Riggs' Disease, or Pyorrhœa Alveolaris.*

BY F. NEWLAND PEDLEY, F.R.C.S., L.D.S.ENG.

MR. PRESIDENT AND GENTLEMEN,

AT our last meeting but one a "Casual Communication" was brought forward on the treatment of Riggs' Disease, and a desire was expressed that some one should open a discussion on its pathology at an early date. I volunteered, and subsequently acceded to the request of our Secretary that I should read a paper on the subject at this meeting.

We must all admit that it is a very unfortunate thing for a disease to be christened after the name of its discoverer, for there is always a doubt whether his description was correct, and even where it is shown that the original interpretation was entirely wrong, the name may long survive to perpetuate blunder and bar the road to a more accurate perception.

How much greater does the difficulty become when a lesion is named after a man who never recorded a description of it! At a meeting of the American Dental Association in 1877, Dr. Rehwinkel, Chairman of the Committee of Pathology, stated that "he had recently addressed Dr. Riggs for some account of his views, but had failed to receive any response. No printed reports or



statements of Dr. Riggs were to be found. . . . It would be well if Dr. Riggs could be induced to make a statement of his views through the journals," &c.

This challenge was never responded to, and in the year 1881, at the Medical Congress, Dr. Riggs denied that he had been personally instrumental in attaching his name to the complaint. But we are aware that Dr. Riggs invented a series of instruments for removing tartar buried beneath the gum, and hence the use of his name would wisely be confined to describe a form of treatment by scraping, directed against certain abnormal conditions of the gums, which he recognised as peculiar, but attributed to the effect of tartar.

Years went by and the designation Riggs' Disease was retained, although it was used with quite a different meaning to the original, by many who applied it to a lesion of constitutional origin, and not necessarily associated with salivary calculus. To obviate this confusion the appellation *Pyorrhœa Alveolaris* was substituted for Riggs' Disease. This more recent name is not free from the objection of being a generic term merely indicating a symptom, and it requires a sharp definition to intimate in what sense we elect to adopt the title. For the general acceptance of the term *Pyorrhœa Alveolaris*, by dentists in Europe and abroad, assumes that we all recognise a certain definite disease to which

it is applicable, and when a distinctive title is given to a complaint a definition should be forthcoming, which in turn should be based on its pathology. Unhappily *Pyorrhœa Alveolaris* received a compromising name first, and still lacks a satisfactory pathology. In this dilemma we must, to-night, select the salient physical features and naked-eye appearances upon which we rely to distinguish this particular disease from others to which it bears points of resemblance, to do duty as a definition, and serve as a fixed point from which we can discuss and develop its pathology. Eventually I trust we shall be able to endow the lesion with a name of scientific import.

The local conditions to which the terms "*Pyorrhœa Alveolaris*" or Riggs' Disease have been applied, may be briefly quoted thus from the description of well-known authors. The mucous membrane, especially that adjacent to the teeth, appears deeply congested with venous blood, tumid and thickened, but not filling up their interstices at their necks, and detached for some distance from the surface, from the fangs. A thick fœtid discharge may often be pressed up between the teeth and mucous membrane which gives to the breath a very repulsive odour. This condition of things continuing, the alveoli become absorbed, and at times more or less denuded, whilst the fangs of the teeth become coated with a layer of thin, hard, green-brown tartar.

Ultimately, the disease progressing, the teeth one after another drop out. The alveolar margin is sometimes thickened in substance. The pain varies, it may be neuralgic from the first, but it is not generally considerable until the periosteum is fully involved.

Various theories have been advanced in explanation of the appearances and conditions occurring in the above complaint. I do not purpose going deeply into the germ theory. Doubtless numerous varieties of germs have been found in the purulent discharge from the alveoli, and an epidemic form of the disease is said to have appeared in Switzerland, and to have disappeared as rapidly as it came. The discharge contained peculiar micro-organisms, but the researches of modern bacteriology would not justify the conclusion that these germs were necessarily the cause of the disease; for even in the case of the well-known bacillus of tubercle, the question remains to be decided whether the bacillus is the cause or effect of the complaint.

American literature supplies us with a "catarrhal theory" for Pyorrhœa Alveolaris, based on the fact that the alveolo-dental membrane is continuous in structure with the deeper layer of the mucous membrane. It is suggested that catarrh of the mucous membrane of the mouth causes sloughing of the alveolo-dental membrane by cutting off the



blood supply. A serious objection to this is that the chief vascular supply to the lining membrane of the alveolus is not derived from the mucous membrane of the mouth. We need also tarry little over another point, which consists in the statement that in some cases of *Pyorrhœa Alveolaris* pus was absent. Little importance need be attached to this, for the amount of pus formed is merely an index of the intensity of the inflammation, and the vascularity of the part. Chronic inflammation may well exist without pus, or the pus may be present, though invisible to naked-eye examination, or may be entirely absent at times, though present and visible at others.

The relation of salivary calculus to *Pyorrhœa Alveolaris* is a question of great moment, for in the opinion of many dentists, tartar is the origin and essential cause of the complaint. This is obviously unsatisfactory as regards the ordinary crusts of calculus that are so commonly found clothing the crowns of teeth. All dentists see innumerable cases of this description, in which the gum and socket may recede as the result of the mechanical irritation from the calculus; but there is no considerable separation of the periosteum from the root of the tooth, and simple removal of the tartar and attention to cleanliness arrests the progress of the evil. But grave attention is frequently drawn to a thin layer of calculus that is found upon the

roots of teeth, extending upwards beneath the inflamed periosteum of the tooth, and in some cases reaching the very apex of the root. The characters claimed as distinctive of this layer of deposit are that it is nodular, harder, and of a different colour to ordinary tartar; but it must be remembered that the calculus deposited beneath the periosteal pouches is subject to different conditions to that on the exposed portions of the tooth. Old tartar is often hard and nearly black in colour, and that which forms beneath the margin of the gum remains protected from removal by accident, mastication, or the use of a tooth-brush. Tartar mixed with pus is green. The nodular character of the deposit is probably attributable to the irregularity of the surface of the alveolus, and of the inflamed lining membrane, in contact with which the nodules are formed. The fact must not be disregarded that the deposit on the submerged roots is braided during its development with pus and effusions from the inflamed periosteum and gum. The difference in colour is not irreconcilable with the salivary origin of the deposit, when we remember how vastly tartar varies in shade under altered conditions, and in respect of its age; yet a formidable theory has been based chiefly on this variability of colour, which ascribes a "sanguinary" or "serous" origin to the nodular deposits that form beneath the margin of the gum.

Dr. Ingersol, an American dentist, discovered an "induration of granular formation" at the apex of a tooth that he had extracted, and he affirmed that he subsequently observed twenty such cases. Analysis showed dark colouring matter in these formations which, in his opinion, were only found in connection with ulceration, and this material he called "sanguinary calculus" because he inferred that it could not have come from the saliva.

To establish his point it would be necessary to prove that these calcareous deposits were entirely inaccessible to saliva. It is an eloquent coincidence that the analysis only differed from salivary calculus in the presence of colouring matter, and, granting for the moment that this were effused as some form of hæmoglobin from the capillaries of the inflamed periosteum, it would not necessarily follow that the calcareous deposits came from the same source. None would be prepared to express surprise that an irritated periosteum should occasionally deposit on the root of a tooth small masses of calcareous material similar in nature to callus or osteophytes. In the vast majority of instances the nodular deposit on the roots of teeth is plainly observed to progress in a direction from the cervix towards the apex, and not the reverse. It may here be mentioned that tartar has never been seen upon the surface of an unerupted tooth.

One other form of salivary calculus should be



referred to, and that is the annular collection of hard, dark material that is so often found beneath the free edge of the gum. Its formation and longevity are favoured by the protection of the margin of the gum, even in the mouths of many patients who give scrupulous attention to the use of the tooth-brush. Hard food and careful brushing may remove every vestige of tartar from the exposed portions of the teeth without being able to prevent the formation of a ring of calculus beneath the shelter of a gum margin that may have been congested from one of many causes.

In some cases of *Pyorrhœa Alveolaris* there has been no tartar whatever found on the roots of teeth extracted, but unfortunately this is not a final argument, for it may be legitimately urged that a thin layer of tartar might have been present originally, but was dissolved away by the vitiated secretions of the mouth, which had undergone a change in character and chemical reaction.

The presence of salivary calculus is insufficient in itself to account for a special disease with features of constitutional origin, and there is ample reason for seeking the cause of *Pyorrhœa Alveolaris* in a systemic condition. It is known to occur in the mouths of patients whose health has been undermined by debilitating influences and injudicious habits of living. Frequently the disease is seen to attack the opposite sides of

the mouth in a symmetrical manner. This is opposed to the assumption of a local origin of the affection. Cases have followed the prolonged use of mercury, iodide of potassium, or chloride of sodium, though it is open to doubt how far the blame should rest on the complaints for which these drugs were taken. *Pyorrhœa Alveolaris* is a common sequel of malarial fever in America, and these patients are said to experience a great craving for salt.

Young patients recovering from eruptive fevers are sometimes subjects of *Pyorrhœa Alveolaris*. Frequent pregnancies are a ripe source of the disorder.

The recent researches of Mr. Bland Sutton in Comparative Dental Pathology have supplied us with invaluable data. He established the fact that animals kept in captivity suffered from premature loss of teeth. Mr. Sutton collected numerous specimens of recession of the alveolar process, both when tartar was present and when it was not. At a meeting of the Pathological Society he showed a considerable series of the skulls of monkeys whose jaws were affected with recession of alveolus as the result of rachitis, and he recorded a similar condition occurring in a case of *mollities ossium*. During the time I was Dental Surgeon to Evelina Hospital, and since, I have seen many cases of premature loss of teeth from recession of alveolar process and

gum in rachitic children. Mr. Bland Sutton showed that, in the case of lions kept in captivity, unsuitable food, by preventing the assimilation of lime salts, produced cleft palate in the progeny. Also, that a series of pregnancies at short intervals in the case of a female dog led to similar defects in the osseous system of the offspring by exhausting the maternal store of lime salts. Also, that in a snake kept in captivity the bone of attachment became absorbed, leading to the loss of the teeth, which were abnormal in size, number, and attachment. The consideration of the above three facts in connection with one another offer a striking parallel to the hereditary form of *Pyorrhœa Alveolaris*, and suggest that an element of the complaint might be hereditary defects in the structure of the teeth and alveolar process.

Here one may cite the experience of all dentists that the removal of affected teeth usually cures the lesion where the teeth have stood, and that the disease has a tendency to spread from affected teeth to those in their neighbourhood.

Attention has recently been drawn to *Tabes Dorsalis* in connection with the premature shedding of teeth. I recently examined two cases of advanced *Tabes Dorsalis* in the wards of Guy's Hospital. The disease was well marked, and neither patient had ever used a tooth-brush, but there was no evidence of *Pyorrhœa Alveolaris*. All



wasting diseases and depressed conditions of the nervous system are conducive to the premature shedding of the teeth, but *Pyorrhœa Alveolaris* is not a necessary concomitant of advanced *Tabes Dorsalis*. My friend Dr. Hale White is present to-night, and I leave this phase of the subject in his able hands.

Whilst a depressed condition of the constitutional strength is the most important factor in determining the disease *Pyorrhœa Alveolaris*, local causes favour its development, and in patients of this systemic tendency the outset of the attack may be traceable to some slight influence, such as the use of a very hard tooth-brush, coarse tooth powder, or the like. A crowded arrangement of the teeth may occasion it, or one tooth may be so placed that the mucous membrane around it escapes healthy friction and becomes the seat of the mischief. No doubt the subsequent deposit of tartar on the denuded portion of the root aids as a foreign body in keeping up irritation of the periosteum.

One gathers from the somewhat diffuse literature of this subject a consensus of opinion that the early stage of *Pyorrhœa Alveolaris* is characterised by an hypertrophied condition of the muco-periosteal fold around the teeth, accompanied by dilatation of capillary loops, enlargement of papillæ, and rapid proliferation of epithelial cells. Later on the gum becomes firm and contracted, and displays increase

of fibrous tissue. What changes go on in the socket during the recession of the alveolar margin I am unable to state, for the simple reason that I cannot get a recent specimen. The theory seems to be widespread that the inflamed periosteum becomes separated from the subjacent alveolar margin, thus depriving it of its vascular supply, and leaving it denuded, rough and carious. This may be so in some cases, but there are many in which the alveolar margin recedes and yet the result of probing is opposed to the supposition that the bone is bare. In these instances the socket wastes without becoming denuded of its periosteum.

At the Medical Congress in 1881, Dr. Walker opened a discussion on Riggs' Disease and exhibited a number of microscopic specimens, the conclusions he arrived at being that in the present state of pathological knowledge no distinction could be traced between the loss of a tooth socket prematurely by disease, its absorption after extraction, or its wasting in old age, the microscopic characters being identical, viz.: loss of vascularity, increase of fibrous tissue, subacute inflammation passing into the depths of the alveolar processes adjacent to the inflamed gum. The report does not mention to what extent this hypothesis was accepted, and the microscopic appearances described are unsatisfactory in this respect, that the section that would

represent *Pyorrhœa Alveolaris* was taken from the mouth of an aged dog whose teeth were loosening.

The Museum of the Odontological Society possesses specimens, presented by Mr. Bland Sutton, of the skulls of animals which died in captivity, and whose jaws show evidence of a disease which seems to be an analogue of *Pyorrhœa Alveolaris* in the human subject. One of these, the skull of a carnivore, is very striking. There is not an even recession of the bone from the margin towards the apex, but the alveolus is obviously attacked to some distance from the margin. Where teeth have recently been lost, the surface of the bone shows depressions and hollows, irregular in outline, with eroded patches and a few spicules of bone that are apparently of new formation. Where the destructive process is at its full activity around a tooth that is being lost, a wide space is noticed to have formed between the tooth and the jaw, by absorption of the bone and the roots of the tooth. The space between the tooth and the jaw is as great at the apex of the root as at the neck. Around the affected tooth the alveolus is lost on the buccal surface, and wherever the root is laid bare it is coated with greenish-brown tartar, but the destructive process is seen to be going on in places where no tartar is present. There is a very peculiar appearance about the



alveolar septum between the roots of the teeth, at those parts where it is thickest and most vascular. Here one can trace the outline of what its shape has been, but the bone has been reduced to a condition suggestive of filligree or trellis-work, and the last support of the loosening tooth is obviously pedicles of alveolar process with efflorescent extremities of sponge-like bone. The cementum on the root of the teeth is thinned, and the root itself is greatly truncated by absorption. The general impression remaining is that one is examining a case of osteitis extending from the margin of the alveolar process to a point some little distance beyond the level of the roots of the teeth, and by no means going hand in hand with the deposit of tartar.

The result of local treatment aids us by demonstrating the very refractory nature of well-marked cases. The thorough removal of any tartar from the roots of affected teeth by means of instruments and chemical reagents, and the subsequent use of astringents, gives good results, at least temporarily, by allowing the gum to more closely embrace the roots of the teeth, and preventing the accumulation of tartar and discharge in the alveolar pockets; but relapses are common, and our main attention must be directed to general constitutional treatment, which comes within the domain of the physician.

The inferences that follow from the points I have enumerated lead to the assumption that the affection which to-night we are calling *Pyorrhœa Alveolaris* is essentially of constitutional origin. In man and in the lower animals it is found connected with wasting diseases and depressed conditions of the system. The local exciting cause may be of a very trivial nature.

The weight of evidence tends to place *Pyorrhœa Alveolaris* in the category of bone diseases. The exposed position of the alveolar margin and its intimate relation with organs of such feeble vascularity as the teeth, go far to explain why it is this portion of the alveolus that is first affected, and also the usual arrest of the disease by the removal of the teeth.

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MR. C. J. BOYD WALLIS (Secretary for Foreign Correspondence) afterwards read a translation, prepared by himself, of a paper on the same subject which had been received from Dr. E. Magitot, of Paris, a Corresponding Member of the Society.

*Recent Researches on Symptomatic Alveolar  
Arthritis.*

BY DR. E. MAGITOT,  
Corresponding Member of the Odontological Society of  
Great Britain.\*

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PART I.—HISTORY—DEFINITION—NOSOLOGY.

TO-DAY we desire to again call attention to some particulars concerning the history of *Symptomatic Alveolar Arthritis*, a disease which has for a long time past been described by authors under various titles. We find it in fact described by Fauchard,† in 1746, who considered it of scorbutic origin; later on it was better described by Jourdain, in 1771,‡ who gave to it the title of “*Conjoint Suppuration of the alveoli and gums*”; this title was generally accepted by authors until Toirac substituted for it that of *Inter-alveolo-dental pyorrhœa*. This disease was again the subject of a communication made to the Academy of Sciences by Marchal (de Calvi) in 1861,§ under the name of “*Expulsive gingivitis*.” Some years later on, in 1867,|| we ourselves pub-

\* Translated by C. J. Boyd Wallis, L.D.S.Eng., Hon. Sec. for Foreign Correspondence.

† “*Le Chirurgien Dentiste*.” Paris, 1746. Tome I, p. 275.

‡ “*Maladies de la Bouche*.” Paris, 1778. Tome II, p. 396.

§ “*Comptes Rendus de l’Acad. des Sciences*,” September 10th, 1861.

|| “*Arch. Gen. de Médecine*.” Paris, 1867. Tome I, p. 678.



lished an original paper on this affection, for which we proposed the name of *Alveolo-dental-osteoperiostitis*," a title which has since been generally adopted by authors, and which we have retained in our other communications on the same subject.\* We were led to this choice by the study of the nature and of the anatomical situation which seems to us to characterise this affection.

These lesions consist, in fact, of a derangement of an inflammatory nature, affecting at the same time the tissue which has been called the *Alveolo-dental periosteum*, and the bony covering which is subjacent to it, viz., the cement. The term osteoperiostitis was thus justified by the simultaneous lesion of a periosteal and osseous layer. The expression conformed, moreover, to the rule adopted in France on the subject of medical nosology, which gives to every disease a name corresponding to the anatomical lesions which characterize it.

Be that as it may, this last description does not appear to have satisfied all authors, for several of them have gone back to the term *expulsive gingivitis*, which is evidently incorrect, since the gum is never primarily attacked. Others again have taken up the term *alveolar pyorrhœa*, which term seems to prevail amongst English practitioners, and particu-

\* "Dict. Encyclopédique des Sciences Médic.," art. *Dent.* Series I, Tome XXVII, p. 286.

larly with our colleague, Mr. F. Newland Pedley ; whilst others, Dr. David,\* of Paris, for example, propose to call it Fauchard's disease (*Maladie de Fauchard*), after the name of the author who was one of the first to mention it as described. Following the same idea it is called in England and America, Riggs' disease.

If this tendency to multiply without any definite rule the names of the same disease be persevered in much longer, one calling it from one of its symptoms, *pyorrhœa* or *suppuration*, others giving to it the name of an author who has described it with more or less exactitude, extreme confusion will be the result.

Moreover, amongst this diversity of titles the rule, referred to above, of invariably taking as the basis of nomenclature the pathological anatomy of the disease, is completely forgotten.

Thus, while regretting to add in our turn a new name to a nomenclature already so long, we feel ourselves nevertheless obliged to substitute once more for the designation hitherto employed, a title which, faithfully conforming to the precise rules indicated, will establish the nature of the disease with all the exactitude desirable. This title is that of *Symptomatic Alveolar Arthritis*.

The justification of this choice is very simple. The recent researches made in France, particularly

\* "Gaz. des Hospitaux." Paris, 1886; p. 667.

those by Mons. Malassez,\* have clearly established the fact that that which we have described as *periosteum* around the roots of the teeth ought to be considered, not as a membrane, distinct and capable of being dissected off, like the osseous periosteum, but rather as a true ligament.

This manner of looking at it, already indicated by Kölliker in Germany, and by Ranvier in France, in his courses of lectures at the College of France, is generally adopted in our country. We ourselves are in complete harmony with it, thus accepting the necessity of modifying in our studies the interpretation which we had until now assigned to this part of the dental organ.

The teeth are then in reality articulated with the jaws by the intermediary of a *ligament*, and every lesion of such an articulation ought to be assigned to the category of *arthrites*. We shall, then, henceforth thus describe the affection with which we are dealing.

As to the term *symptomatic*, we are induced to avail ourselves of it for the reason that this form of disease ought to be carefully distinguished from the affection hitherto described under the name of *Alveolo-dental periostitis*, and to which henceforth the name *simple alveolar arthritis* will be most applicable. This latter, which is in fact sometimes spontaneous or traumatic, but more often the result

\* "Arch. de Physiologie." Paris, 1885 ; p. 144.



of the last stages of caries, possesses a character and progress quite distinct from *Symptomatic Alveolar Arthritis*. While the last commences at the neck of the root, the former appears only at the apex. Moreover, the loosening and displacement of the teeth, the initial phenomena in the symptomatic form, are very rarely met with in the simple form. Finally, suppuration of the alveoli does not exist in the latter. Let us add that the word *symptomatic* well expresses the relation which this arthritis holds with regard to the general diseases or diatheses which are invariably the first cause of it. These different specific terms indicate clearly the differential signs of the two affections, which can thus preserve the generic denomination of arthritis, the term *symptomatic* sufficing in our opinion to distinguish that with which we are occupied in this work from that of *simple alveolar arthritis*, which name should remain attached to the ordinary form.

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## PART II.—ETIOLOGY.

As we have already indicated in our previous researches,\* the causes of this disease should be looked for, not in the local conditions of the mouth or gums, but in certain conditions of the general health. The disease ordinarily attacks a single

\* "Arch. Gen. de Médecine : " 1867. Tome I, p. 684.

tooth; occasionally several teeth may become involved, but in the latter case the affected teeth are not necessarily contiguous, they may occupy different positions in the mouth at a distance from each other. Toirac and M. Oudet believe they have observed that the inferior incisors were more particularly the seat. We have not ourselves recognised this peculiarity, which appears to us to belong more especially to gingivitis, which may in certain cases be confounded with Symptomatic Alveolar Arthritis.

The teeth most frequently affected are in order of sequence: firstly, the molars, then the inferior incisors, the bicuspid, the superior incisors, and lastly the canines. We have never observed this disease affecting simultaneously the whole of the teeth. At one time it is situated on one or two inferior or superior incisors, at another the incisors are spared, and one or more molars are affected, ordinarily two or three on different sides of the mouth. Sometimes the disease only attacks a single root of these latter, or it may be only a single side of a root, a circumstance which preserves to the root a certain degree of solidity for a considerable time. The teeth affected with Symptomatic Alveolar Arthritis do not generally present any preceding or accompanying alteration. Caries, for instance, has no connection with this disease, and if this complication is present it is simply an accidental

occurrence. It is, indeed, worthy of remark that the local conditions which accompany the development of Symptomatic Alveolar Arthritis appear to be just the opposite to those which accompany the production of caries; the buccal saliva is in fact rather alkaline than acid, an accumulation of tartar more or less abundant is observed in the places where it is usually met with. One might be tempted on the first glance to attribute to this deposit a part more or less active in the etiology of this disease, but it is not so. The deposit of tartar is a secondary matter, and in all cases, its formation being generally uniform and continuous in the same region, it cannot be cited in the production of an isolated and local affection.

It is very important to note the various conditions presented by those who are the subjects of Symptomatic Alveolar Arthritis. The age at which this affection is generally observed is not either in youth or in advanced age, but between the thirtieth and fiftieth year of age; it is equally frequent amongst men and women, and amongst the latter it appears often accompanied with the complex phenomena of the "menopause." In a certain number of cases Symptomatic Alveolar Arthritis supervenes during a state of perfect health, and whatever pains we may take to find out the cause we cannot recognise it either in the local conditions of the mouth, or in any appreciable disorder of the



economy; nevertheless the temperaments which appear predisposed to it are almost exclusively of the sanguine and bilious varieties; constitutions appearing in other respects vigorous, yet subject to cephalic congestion. Persons of sedentary occupations, those who are engaged in an office, are particularly predisposed to it. We have already mentioned several times the relationship produced by the appearance of the crisis attending the cessation of the menstrual discharge, or of the hæmorrhoidal flux. This influence of temperament has again a close connection with heredity, which in certain families has appeared to us to influence the appearance of the disease; thus it has made its appearance in members of the same family during two or three generations, and in analogous conditions of age and constitution.

Certain intestinal phenomena are observed, whether they be coincidences or whether in etiological connection. Habitual constipation is met with in the subjects attacked, and one of the physicians to the Paris Hospitals, M. Fidal, has observed that they often present dyspeptic phenomena. Perhaps these latter may have been due to difficulties in mastication; in any case we have personally had the opportunity of verifying this assertion. Some general or diathetic conditions exercise a considerable effect on the production of this disease. Thus eruptive fevers have, as is

known, sometimes caused a falling out of the teeth, a result produced by Symptomatic Alveolar Arthritis.

We recently observed in a little girl seven-and-a-half years old, alveolar arthritis following a severe attack of whooping cough. The temporary teeth, and above all the permanent teeth already erupted, were surrounded by pads of inflamed gum, with alveolar suppuration and loosening of the teeth (one out of the first permanent molars had already fallen out, and another was greatly threatened). The affection appeared to consist in an ulcerative stomatitis and a simultaneous Symptomatic Alveolar Arthritis.

Gouty and rheumatic subjects often present this kind of arthritis, as also do individuals attacked with anæmia caused by long illness; but there are no general lesions which exercise a graver influence on the production of this disease than those of albuminuria and, above all, diabetes. As regards the first we are dealing here, as is well understood, not with symptomatic albuminuria, but with what is properly called Bright's disease.

In Glucosuria this phenomenon is absolutely constant, and even constitutes one of the primordial signs of the morbid conditions. In fact it is mostly found in the descriptions of authors that at the commencement of diabetes the teeth become loose and carious. This assertion concerning caries is

not correct, but the first is perfectly so, and corresponds to the Symptomatic Alveolar Arthritis which follows in its development the same course and the same progression as the general disease, causing at its termination the loss of a considerable number or the whole of the teeth. Such are the results of our researches, which we communicated to the Academy of Medicine, under the name of "A Treatise on the Value of Diagnosis in Saccharine Diabetes of Alveolo-dental Osteoperiostitis."\*

We have not recognised in any way that any other conditions of the health were in connection with Symptomatic Alveolar Arthritis. Thus certain diatheses, such as syphilis, in which the tertiary symptoms affect the bones and fibrous tissues, do not appear to produce it; mercurialization and gingivitis, however great its severity, do not appear to become either the principal or even the occasional cause.

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### PART III.—TREATMENT.

We do not wish here to enter fully into all the considerations concerning the treatment of symptomatic alveolar arthritis. We have detailed them to a considerable extent in our previous publications,†

\* "Acad. de Médecine de Paris." Séance du 27 Dec., 1881.

† "Arch. de Médecine:" 1867. Tome II, p. 35.



but we should like to particularly insist on the value of the action of a certain class of remedies which enter into antiseptic medicine.

We are in fact confronted with a septic and contagious disease, of which the essential symptoms are an abundant alveolar suppuration, loosening and displacement of the teeth, recession of the gums—in a word, all the conditions suitable to make of this lesion a spot favourable for the action of septic agents.

These agents undoubtedly exist in this disease. The microscopic preparations of pus proceeding from alveolar diseases have betrayed the existence of a large number of organisms of very diverse forms, amongst which it is, if the truth be spoken, still difficult to distinguish the variety which ought to be regarded as the essential and exclusive morbid agent of this disease. Further researches, we are convinced, will enable us to realise the culture of the pathogenic agent peculiar to Symptomatic Alveolar Arthritis.

Some interesting experiments\* undertaken by MM. Malassez and Galippe for this purpose have already put beyond doubt the parasitic nature of this disease, and it is also confirmed by the frequent propagation of the disease from one alveolus to another in the same mouth, as well as by contagion from one individual to another, as observed

\* “Comptes rendus et Mémoires de la Soc. de Biologie :” 1884; p. 321.

by different authors and ourselves. All that we now wish to insist upon is the value of antiseptics in the treatment of this disease. With this view we would recommend such applications as alcohol, carbolic acid, perchloride of mercury, &c. For this purpose we have selected the following formulæ :—

No. 1.	℞	Hydr. perchlor.	..	0 grms. 50 c.g.
		Aq. Destil.	..	1000 „
No. 2.	℞	Acid carbolic crystal	}	aa 5 grms.
		Ether	..	
		Alcohol	..	10 „
No. 3.	℞	Acid borac.	..	10 grms.
		Aq. Destil.	..	500 „
		Alcohol	..	50 „

To these formulæ we could have very well added others by employing other antiseptics, such as the permanganates, salicylates, salicylic acid, &c. It will be necessary besides to have recourse to the employment of medicines which will modify the local condition, as well as to attend to the treatment of the general health, paying due regard to the diatheses which influence the disease.

Thus the treatment of Symptomatic Alveolar Arthritis can be summed up in the three following paragraphs :—

- 1st. To render antiseptic the alveolus, the seat of the arthritis.

2nd. To modify the condition of the affected tissues by the application of astringents and caustics.

3rd. To treat the general conditions or diatheses which govern the local manifestations.

We will not refer again to the employment of antiseptics.

Concerning the second point—that is to say, the local treatment of the affected tissues—it is known that we have advocated applications of chromic acid, employed chemically pure and monohydrate, as a powerful caustic susceptible of acting on the vitality of the tissues of the gum and, above all, on the dental ligament. Let us add that chromic acid may also be considered at least equal as an antiseptic to any of the drugs usually employed in that sense. We can mention again among the modifying agents, pure carbolic acid, chloride of zinc, and lastly heat applied by means of the galvanic cautery.

Finally, as concerns the diatheses, the dominating influence of which we have already referred to, we shall not here indicate the treatment so as not to exceed the limits of this paper.

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## PART IV.—CONCLUSION.

From the preceding considerations we believe we may deduce the following conclusions:—

- 1st. The affection characterised by alveolar suppuration, by the loosening and falling of the teeth, ought to be considered as a true Symptomatic Alveolar Arthritis, septic and contagious, and which ought henceforth to remain known by that name in surgical nosography.
  - 2nd. This affection is most often met with under the influence of certain general conditions and diatheses, and as secondary to eruptive fevers, &c., of which it may form either a complication or a sequela.
  - 3rd. The therapeutics of Symptomatic Alveolar Arthritis ought to consist essentially in the employment of antiseptics, of local alteratives, astringents, or caustics, without prejudice to the treatment of the general conditions which are its determining causes.
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## DISCUSSION.

THE PRESIDENT remarked that the term "arthritis," used by Dr. Magitot, would probably sound strange to most of those present, though it did not really mean anything very different from what they were accustomed to. It was based on the opinion, held by the author of the paper and others, that what was generally known in England as "the alveolo-dental membrane" was, properly speaking, a ligament, and that inflammation of it should not, therefore, be referred to as *periostitis*, but as *arthritis*. This view of the nature of the alveolo-dental membrane was founded, in part, on Comparative Anatomy.

DR. HALE WHITE said he had been interested for some time past on the subject under discussion, having had his attention called to it by the premature loss of the teeth which occurred in cases of *Tabes Dorsalis*. He showed a tooth which had fallen from the mouth of a patient affected with this disease. It was a lower molar; there was a little tartar on it, but its loss had been unaccompanied by any signs of inflammation. This falling of the teeth was, according to some authors, a rare but genuine symptom of *Tabes Dorsalis*, and there were apparently two ways in which it could occur. The soft structures around the jaw might swell, and one by one the teeth might fall out, although themselves quite sound; this might be followed by some necrosis of the jaw with discharge of a sequestrum. Or the teeth might fall out without any apparent cause, and the patient might lose a number of sound teeth within a few days without any pain or swelling of the gums. Richardieu had recorded an example of the first kind, whilst examples of the second had been recorded by Hoffman, Lewis, Vallin, Demange, Gowers, and Féré. In many of the cases it was an early symptom, but still it was a rare one; indeed, it was a question on which the dentist might be able to give the general physician some information, whether the teeth fell

out more commonly in persons suffering from *Tabes Dorsalis* than in persons not so affected. He (Dr. White) was inclined to think that the teeth might fall out in many diseases, and that such an occurrence should not be exalted to the position of a symptom peculiar to *Tabes Dorsalis*.

Dr. White next referred to the atrophy of the lower jaw, described by Féré, as sometimes accompanying *Tabes Dorsalis*, and inquired whether dentists had met with such a condition of jaw. Disease of the tempero-maxillary articulation had also been described and regarded as significant of this disease, but it seemed probable that this also was only a coincidence, and that it was really caused by rheumatoid arthritis.

He should, further, be glad to know whether any examples of incoordination of the muscles of mastication had ever been observed by any of the members, and was the use of the "jaw-jerk" of any advantage?

In trying to trace cause and effect in these cases, it must be remembered that any wasting disease would affect the teeth also, whilst on the other hand any difficulty in mastication would lead to impaired nutrition.

MR. J. BLAND SUTTON, in reply to an invitation from the President, said he had come to learn and not to speak. He could only endorse the views which Mr. Pedley had expressed in his paper. The disease was undoubtedly chiefly of constitutional origin, but it also required local treatment; and as the physician did not consider that the teeth were in his province, and the dentist thought the constitution was not in his, the treatment of this disease fell between two stools. He had examined a large number of cases of rheumatoid arthritis, and found that premature loss of the teeth was a very common feature. It was also met with *mollities ossium* and in other wasting diseases. As to *Tabes Dorsalis*, it was, he believed, only a name for a group of symptoms not connected with any definite pathology. It was, however, a curious fact that some of the carnivora got symptoms closely resembling those of locomotor ataxy in the human subject,



including the falling out of the teeth and absorption of the alveoli.

To arrive at a proper understanding of Riggs' Disease it was necessary not only to look in the patient's mouth, but also to note carefully the constitutional state, and especially any indications of the presence of rheumatoid arthritis, and to obtain particulars of the patient's family history. It was only by the careful collection of facts that it could be ascertained whether Riggs' Disease was really a disease, or whether the name was merely a convenient cloak for ignorance.

MR. F. J. BENNETT said Mr. Pedley appeared to consider the vascular supply to the periosteum was derived principally from the vessels of the pulp and of the alveolus. But it was a fact which could be clearly seen from specimens in the Museum that there was a very free supply from the submucous tissue of the gum. The capillary network where the gum joined the neck of the tooth was very peculiar from the looped arrangement of its vessels, a description and illustration of which was given in Salter's "Dental Pathology," and in Tomes' "Dental Surgery" there was a figure of an injected specimen showing the vessels much enlarged in a monkey.

Tracing the course of the disease, it would be found that the first symptom was increased vascularity at the gingival margin and separation of the gum from the neck of the tooth; that there was a strong tendency for this part to become congested, and that this congestion was followed by effusion into the submucous tissue, causing gradual destruction of the fibrous attachment of the periosteum to the tooth.

The belief in the dependence of Rigg's Disease upon tartar appeared to be still very general, but a strong argument against this was that cases were frequently met with in which persons had large accumulations of tartar which had been forming for years, but yet had not caused separation of the gum from the tooth. This, he thought, was quite sufficient to show that there was no necessary connection between the presence of tartar and Riggs' Disease.

He agreed with Mr. Pedley that the disease was predisposed

to by causes which brought about a lowered state of the constitution, as anæmia, dysentery, frequent pregnancies, feeble circulation, &c.

MR. S. J. HUTCHINSON said he wished to say a word in defence of the name by which the disease which was the subject of discussion had been generally known for some years past. He was quite aware that Dr. Riggs was not the first to recognise the disease, but that the symptoms were accurately described in the first edition of Tome's "Dental Surgery." But Dr. Riggs was the first to point out that the removal of the free edge of the alveolus had the effect of checking to a considerable extent the progress of the disease. He had in fact pointed out the only method of treatment which had hitherto proved successful, and he (Mr. Hutchinson) thought that the connection of Dr. Riggs' name with the disease was not an undeserved compliment. It must be admitted that the profession was still in darkness as to the origin of the disease, and further investigations into its etiology and pathology were greatly needed.

DR. WALKER said he should be pleased to present to the Society the sections (eighteen in number) which had been prepared for examination by the members of the International Medical Congress of 1881 by Dr. Gibbes, and to which Mr. Pedley had referred in the course of his paper. The members could then examine them at their leisure, and form their own opinions respecting them.

MR. MOORE said it had been stated that evening that Riggs' Disease never affected all the teeth. With reference to this point he would mention the case of a lady, aged thirty, whom he had treated for this disease about fifteen years ago. All her teeth were loose, and covered with hard nodular tartar from the crown to the apex of the root. Various remedial measures were tried, but proved useless, and eventually all her teeth had to be extracted.

The PRESIDENT said that some years ago, when on a visit to the States, he saw Dr. Riggs carry out his treatment in a

good many cases. He did not remove the edge of the alveolus, for this was already gone before the cases came under treatment, but he gouged out and scraped away all the softened bone surrounding the affected teeth. His treatment was somewhat severe, but its *immediate* effects were certainly very good. In all the cases, however, which he (Mr. Tomes) had been able to trace out afterwards, the disease had recurred and ran its usual course.

The question with reference to the connection of tartar with the disease, which had been referred to by several speakers during the discussion, received, he thought, some elucidation from a specimen in the Museum. On looking at this it would be seen that the ring of hard tartar surrounded the tooth at some distance from the edge of the alveolus, and that the surface of the tooth between these points was quite clean. It seemed evident from this that the tartar could not be the cause of the absorption of the bone.

With reference to what had been said about the premature loss of teeth by patients suffering from locomotor ataxy, he could only say that in two cases of this disease which had come under his notice the teeth were in a perfectly healthy state. In both cases the disease was at a comparatively early stage.

MR. HERN said the majority of those who had taken part in the discussion appeared to agree in considering that Riggs' Disease was of constitutional origin, and he thought hardly enough attention had been paid to its local causes. It appeared to him that a good deal might be said in opposition to the theory of its being a constitutional disease. In the first place many of those who suffered from Pyorrhœa Alveolaris were in what might be termed vulgar good health. Then it was not unusual to find a single tooth affected in the upper or lower jaw, and sometimes only a single root, as the palatine root of an upper molar, the other being healthy. The way in which the disease spread on either side of an infected centre was much more suggestive of a local than of a general origin. The effect of local remedies also served to strengthen this view, and the



fact that the disease could be checked, if not cured, by antiseptics. He thought that the difficulty in effecting a permanent cure arose from the fact that sufficient attention was not paid to the disease in its early stages. The following case, he considered, told in favour of a local origin. A patient came to him complaining that a tooth in the upper jaw was very tender. The gum round the neck of the tooth was much congested, and on feeling with an instrument he found a ring of characteristic hard nodular tartar hidden by the swollen gum. In removing this he came upon a bristle of a tooth-brush, and this had evidently been the cause of the trouble. With a little attention the part soon returned to a healthy condition.

DR. FIELD said he could not elucidate the pathology of the disease, but should be glad if he might be allowed to say a few words with regard to some practical points in connection with it. He would repeat what he had stated before the Society not long since, that cases of genuine Riggs' Disease were comparatively rare, and he doubted if one had ever been cured. He knew that Dr. Riggs and others asserted that they had cured cases, but he himself had never yet seen a patient permanently cured. The disease was invariably connected with a depressed state of the nervous system. In several of the cases he had seen the patient was suffering from Bright's Disease, and one was suffering from locomotor ataxy. Medical and dental treatment must go hand in hand. Locally he still used Dr. Riggs' instruments, carefully removing all tartar and then applying aromatic sulphuric acid. The gums should at the same time be stimulated by rubbing and by massage with the fingers. By these means good results could be obtained for the time, and the progress of the disease checked, but he almost despaired of obtaining a permanent cure.

DR. GEO. CUNNINGHAM thought that if Dr. Field would make further inquiries he might be induced to modify his opinions. It was Dr. Mills, of Brooklyn, who was chiefly instrumental in getting Dr. Riggs' name attached to the disease. He

himself suffered from it, and was cured by Dr. Riggs. Dr. Riggs was a very modest man, and no reflections could be thrown upon him for the use which had been made of his name.

It was certainly very desirable that more exact knowledge should be obtained with reference to the pathology of this disease, and he would suggest that if dental students would examine the mouths of all the cases brought to the *post-mortem* room they would be sure to come upon examples of Riggs' disease, and might obtain sections which would be far more reliable than any which could be got from animals.

MR. STORER BENNETT said he should like to call the attention of members to the fact that there were a number of very interesting specimens of premature absorption of the alveoli to be seen in the Museum, and he thought that if members would take the trouble to investigate them carefully, they might add a good deal to their knowledge of the subject.

MR. PEDLEY, in reply, said he could not agree with Dr. Magitot in thinking that the disease was contagious. He had never heard of a dentist getting it from a patient, and as to its spreading to contiguous teeth, it spread, not by contagion, but by continuity of tissue. As to the germ theory, this had been frequently suggested, but never proved. No doubt there was an abundance of germs present, but it could not be proved that any of these were specific. In the discussion which took place on this subject at the International Medical Congress of 1881, Dr. Arkovy announced that he had discovered and cultivated some organisms which he thought were peculiar to this disease, but these observations had never been confirmed, and Dr. Arkovy himself did not appear to have thrown any further light on the subject.

Dr. Magitot also denied that syphilis or mercurial treatment predisposed to Pyorrhœa Alveolaris. He (Mr. Pedley) could only say that this did not accord with his experience.

So far as his limited experience enabled him to judge, he thought Dr. Hale White was right in concluding that there

was no direct connection between Riggs' Disease and *Tabes Dorsalis*. Certainly in the cases of this disease which he had examined at Guy's Hospital the gums were quite healthy.

He was not surprised to hear from Mr. Sutton that patients who suffered from osteo-arthritis were liable to suffer also from *Pyorrhœa Alveolaris*; it only confirmed his experience that it was a frequent complication of all chronic diseases resulting from constitutional debility.

Mr. F. J. Bennett supported the "catarrhal theory." Some cases of congested gum margin might be explained in the way he had suggested, but his theory certainly would not account for the course and symptoms of *Pyorrhœa Alveolaris*.

Dr. Walker had kindly offered to present his series of specimens to the Society. He (Mr. Pedley) readily admitted that several of these were valuable and instructive, but he objected to the sections taken from the jaw of an old dog which was losing its teeth being regarded as typical of Riggs' Disease.

He could not quite understand the grounds on which Mr. Hutchinson advocated the retention of the name "Riggs' Disease." He gathered that Mr. Hutchinson wished to retain it because it commemorated a method of treatment which was based on a theory which was now known to be incorrect, and which had itself proved unsatisfactory in practice.

He congratulated Dr. Field on having changed his opinions since 1877, and come round to what he believed to be a truer view of the case.

Dr. Cunningham had alluded to what he said was "a genuine case of Riggs' Disease," but as there was no definition of Riggs' Disease to be obtained it was impossible to say exactly what was meant by "a genuine case." Dr. Riggs attributed the disease to the effects of tartar, and his treatment was intended to effect its removal. There was no doubt that the treatment did do good for a time, but only by the removal of *débris*, and to deal thus roughly with diseased bone, breaking and lacerating it with instruments, appeared to him on the face of it an unwise course to pursue.



Mr. Tomes had referred to a specimen in the Museum which showed clearly that tartar was not to be found where the destruction of bone was going on most actively. He (Mr. Pedley) had alluded to this in his paper, and he had no doubt had the same specimen in mind.

Mr. Hern appeared to think that a ring of hard dark tartar was the distinguishing characteristic of Riggs' Disease. What then would he call the cases in which there was no tartar to be found, but which were identical in every other respect?

The PRESIDENT then proposed a vote of thanks to the contributors of Casual Communications, and the authors of the papers read during the evening, and announced that at the next meeting, on May 2nd, a paper would be read by Mr. Hern on "Cocaine as a Local Anæsthetic in Dental Surgery."

The Society then adjourned.

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The following nomination has been received by  
the Council :—

HORACE JOHN GOULD, L.D.S.Eng., Madras,  
India.





# Odontological Society of Great Britain.

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## ORDINARY MONTHLY MEETING.

*May 2nd, 1887.*

CHAS. S. TOMES, F.R.S., PRESIDENT, IN THE CHAIR.

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THE Minutes of the previous meeting having been read and confirmed,

MR. FRED. ARTHUR CANTON signed the Obligation Book, and was formally admitted to membership by the President.

THE PRESIDENT announced that MR. HARRY BALDWIN, L.D.S.Eng., 37, Cavendish Square, W., had been duly nominated as a candidate for membership.

THE following candidates were then balloted for and elected members of the Society, viz.:—

MESSRS. WILLIAM BROMFIELD PATERSON, F.R.C.S. and L.D.S.Eng., 46, Brook Street, Grosvenor Square, as a Resident Member; and

ALFRED KENDRICK, L.D.S.Eng., Bridge House, Taunton; and

C. A. HAYMAN, L.D.S.Eng., Belle Vue, Clevedon, Bristol, as Non-resident Members.

THE receipt of a volume of Smithsonian Reports and of the Year Book of Learned Societies for 1887 was announced by the Librarian.

DR. ST. GEORGE ELLIOTT showed in action a hot air engine made by Koerber, of Poland Street. Its advantages were

that it was moderate in price, took up little room, was noiseless in action, and did not give off products of combustion. On the other hand it was not powerful enough for general laboratory work, and consumed rather more gas than an Otto gas engine—six feet an hour instead of four feet. But practitioners who only wanted a machine of small power for running the dental engine would find this one very convenient.

Dr. Elliott added that he was sorry to say he had received a very small number of replies in answer to his call for papers, &c., for the International Medical Congress at Washington. He had been in correspondence with Drs. Taft and Bogue, and had made efforts to get a fair representation for this country on the executive of the Section, and he hoped with success. He trusted that some of those who could not attend the Congress in person would nevertheless send papers to be read at the meetings.

DR. WALKER showed some models sent by Mr. J. Humphreys, of Birmingham.

Two of these were from the mouth of a strong, healthy man, aged twenty-three, and showed an extraordinary amount of erosion. Many of the teeth were worn down to the level of the gum. The dentine was very hard, and the pulps completely calcified. The patient had always enjoyed good health, and had never suffered any pain. Dr. Walker remarked that erosion to such an extent at so early an age would be very unusual, and he thought that it was probably rather a case of attrition than of true erosion.

Another was from the mouth of a child three years old, and showed six well-formed incisors in the upper jaw. The third (girl, aged thirteen) showed a supernumerary right upper lateral, and the fourth (girl, aged fifteen) a supernumerary left upper lateral. The two last were sisters.

MR. E. LLOYD WILLIAMS showed an improved form of hot air syringe, designed by Mr. Rowney, of Derby, and expressed his belief that those members of the Society who had been converted to the consistent use of hot air in their every-



day practice would find the instrument of great practical service. The current of air was produced by a small foot blower, and passed through a coil of brass tube heated by a small Bunsen flame. The warm air was conveyed to the back of the mouth by a bent nozzle, which, however, could be detached when the instrument was used for cavities in the front of the mouth. Two forms of the syringe were passed round, one having a Bunsen burner attached, whilst the other was adapted for placing on an ordinary bracket annealing burner or spirit lamp. A good working temperature could be obtained in a little less than a minute, and was maintained for three or four minutes; it was readily controlled by regulating the flame. The syringe was exhibited in working order at the close of the meeting.

MR. BOYD WALLIS showed a model of the upper jaw of a boy aged eleven, who had a most abnormally large central incisor.

The PRESIDENT then called upon Dr. Geo. Cunningham to read his paper on "The Physiological Action of Cocaine." At the conclusion of which Mr. Herne followed with one on "Cocaine and its use as a Local Anæsthetic in Dental Surgery."

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*On the Physiological Action of Cocaine on the Lower Animals and Man, and its Use in Dental Surgery.*

BY GEORGE CUNNINGHAM, B.A. (Cantab.), D.M.D.  
(Harvard), L.D.S. (England).

It having been suggested that some authoritative utterance should go forth from this Society as to the value and use of cocaine in dental practice, with the view of removing the suspended judgment of our profession on a matter of so great importance, I need have no hesitation in bringing before you certain carefully recorded cases in which my experience in the use of the drug differs most materially from that already laid before this Society. As for some time past I have been endeavouring to investigate the matter in the laboratory as well as in private practice, and as the series of investigation was not complete when I heard the subject was to be brought before you this evening, I must claim the indulgence of the members of this Society for a certain hastiness of preparation in my communication on so important a subject as the Physiological Action of Cocaine.

With regard to the local application of cocaine and its salts, I think there can be no doubt that it has established for itself a permanent place in

the dental pharmacopœia, though it has failed to fulfil the too sanguine anticipations made with regard to it on its first introduction. Any incidental allusions to local applications in the experiments or cases herein recorded, are therefore comparatively of little importance except in so far as they may serve to throw some light upon the action of the drug by injection into the system.

After the very favourable reports on the use of the drug by injection in the communications of Messrs. Hunt, Brunton, and others, I felt justified in employing it in private practice. With what results is shown in the table later on.

*Observations on Cold-blooded Animals.*—Experimental investigation shows that cold-blooded animals are much more susceptible than warm-blooded animals to the action of cocaine. It is important to note its effect upon the heart, the circulation, and the nervous system as affecting sensation and reflex action.

Several experiments which I have made on the general and local action of cocaine on the frog need not be detailed here, as they were found to agree with the numerous experiments recorded by other investigators (Von Anrep, Biggs, Mays).

*Heart.*—The two following experiments were made to ascertain the action of cocaine upon the heart, which is fairly shown by the accompanying tracings.

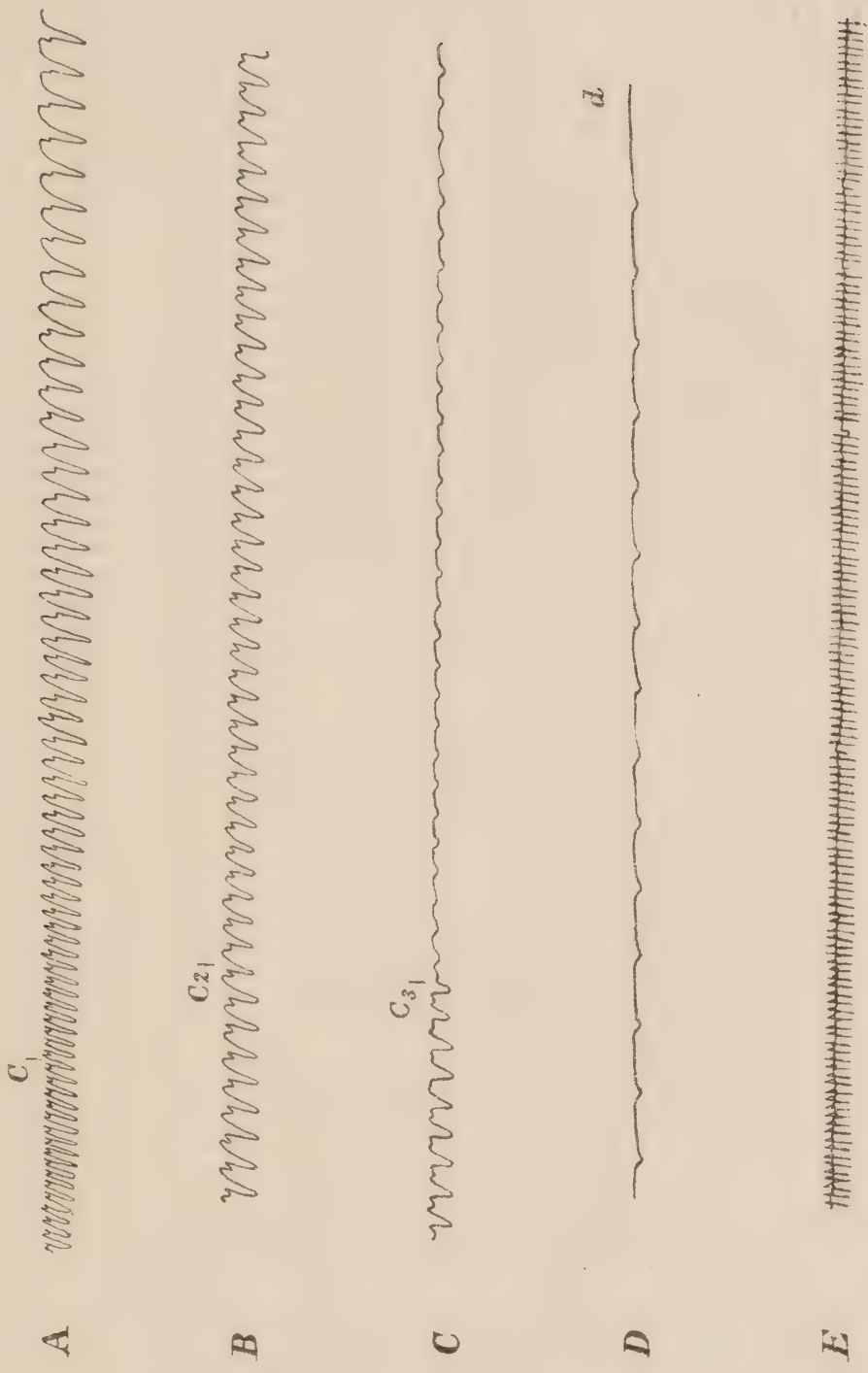


Experiment 1.—Frog pithed, medium size; 1 per cent. solution of cocaine hydrochlorate applied. The apex of the ventricle was attached to the lever recording on a revolving drum. As seen in tracing (A) Plate 1, after application of cocaine solution at (c), the pulsations of the heart became first slower and more forcible, and then the force of the pulsations diminished. Ultimately, after further applications of cocaine ( $c_2$  and  $c_3$ ), the contractions became very feeble and slow (c and d), until arrested in diastole (d). The time trace (E) indicates seconds.

Experiment 2.—Frog curarised, treated as in the former experiment. A few drops of a 1 per cent. solution were placed in the abdominal cavity, producing changes in the heart-beat similar to those in Exp. 1, but only very slightly marked. Hardly any more perceptible change was produced by injecting into one leg under the skin. Very soon after local application to the heart the effects appeared more strongly marked: slowing of the pulsations, which were at first more forcible than originally, then both force and rate diminishing. In this case an irregularity in pulse-beat was seen, soon followed by trigeminal and bigeminal beats, then slow weak beats, until the complete arrest of the heart in diastole took place.

According to Von Anrep the ventricle is first attacked, while the auricles continue to contract

TRACES SHOWING EFFECTS OF COCAINE UPON THE HEART OF THE FROG.







with their usual rhythm, but they also are weakened at a later stage.

The characteristic action of cocaine on the heart of the frog is to decrease the frequency and to increase the force, followed by a diminution in both the force and frequency of the pulsations, with the final arrest of both auricles and ventricles in diastole,—not in systole, as in the case of morphine, digitaline, caffeine, and other drugs.

This characteristic arrest of the heart may be produced by maximal or continued minimal doses, as shown in the tracings (A) and (B).

According to Dr. Mays, of Philadelphia, another characteristic of cocaine is the suddenness with which it depresses the nervous irritability of the heart.

*Blood Vessels.*—The effect of cocaine on the blood vessels is well shown in the following detailed experiment.

*Experiment 3.*—*Frog curarised with the tongue spread out for the observation of the blood vessels under the microscope (micrometer used with a Zeiss A objective and Hartnack No. 3 eye-piece).*

P.M.	
4. 40	Artery corresponds to 6 spaces, vein to 8.
4. 42	A few drops of 1% solution of cocaine hydrochlorate injected into the dorsal lymph space.
4. 46	No change; circulation good.
4. 47	$\frac{1}{2}$ c.c. 1% solution (cocaine) injected. Circulation at once quicker and better; some capillaries have flow re-established in them.

*Experiment 3—continued.*

P.M.	
4.48	Vein if anything wider, but not certain.
4.50	No change in calibre of vessels.
4.51	$\frac{1}{2}$ c.c. 10% solution injected.
4.55	No change in vessels or circulation.
4.57	1 c.c. 10 % solution injected.
4.58	No change in vessels ; circulation slower.
5.0	A few drops of 1% solution applied locally to the tongue—artery 6, vein 8.
5.1	Artery 4, vein 6—narrowing of vessels quite marked immediately after application. Circulation slowing.
5.3	Same local application. Pulsations became at once apparent in the small artery ; the current quite slow during the intervals between the heart-beats ; artery 5, vein 7.
5.4	Artery $4\frac{1}{2}$ ; pulsations slower and more marked in artery—none in vein.
5.5	Artery 4, vein 7 ; no change in circulation between beats ; current almost at a standstill.
5.8	Local application repeated. No change.
5.10	Artery 5. Local application of 10% solution.
5.11	Artery 4.
5.11 $\frac{1}{2}$	Artery 3. No change in the circulation.
5.12	Artery $3\frac{1}{2}$ .
5.12 $\frac{1}{2}$	Artery 4. Local application repeated with exactly same results.

This experiment clearly shows that in this case at least injection even of a large dose did not affect the calibre of the vessels of the tongue, while the local application even of a weak solution immediately produced a marked constriction of both arteries and veins in the part, but more especially of the former. Von Anrep found that injection causes the same effects as local application, viz., marked constriction of the vessels.

*Respiration.*—Small doses (0·003–0·007 gramme) increase the number of respirations, while at first the inspirations are deeper.

Stronger doses after a short increase of respirations produce a decrease with a great difficulty of breathing.

Large doses (0·025 gramme and upwards) cause a slowing and paralysis of respiration without any preceding increase.

In some cases (2 in 13), after a medium dose, a short arrest of respiration was observed. A short period of increased rapidity of rhythm of the respirations, their depth being diminished, was followed by an arrest for several seconds; then occurred some deep inspirations, which again became superficial until another arrest appeared. It is interesting to note this peculiar effect on the respiration in the frog, as it is exactly the kind of respiratory movements we find to be produced in many of our observations on man.

*Nervous System ; Sensation and Reflex Action.*—For our present purpose it is unnecessary to enter into a detailed account of the action of cocaine on the nervous system of the frog. Suffice it to say that both Von Anrep and Biggs agree in their conclusions, viz.: 1st, that small doses increase the reflex irritability of the cord for a short time; and 2nd, larger doses shorten the period of heightened reflexes and decidedly diminish reflex action during a period of longer duration, or may lead to a complete arrest of all reflexes.



The irritability of the sensory fibres is heightened by small doses, which, however, exert no influence on the motor filaments. By large doses the sensory filaments are almost completely paralysed, and the motor filaments are greatly diminished in irritability, but are never completely paralysed.

Several experiments on ordinary nerve muscle preparations were unsatisfactory owing to the torpid state which frogs exhibited at the time (March).

The line of investigation was interrupted early in April by the discovery of how completely the experimental work on the frog has been done by Dr. Biggs, of New York (see "Journal of the American Medical Association," Chicago, 1885, IV, 57-62), and of the very extensive series of experiments on frogs and warm-blooded animals performed by Von Anrep, as far back as 1878-9.

*Observations on Warm-blooded Animals.*—The investigations of the latter extended over a considerable time, and included observations on a large number of rabbits, dogs, cats, and pigeons.

With doses proportional to the weight of the animal, a very varying sensibility to the action of cocaine was observed. Dogs show greater sensibility than rabbits, while cats are even more susceptible, and pigeons less so.

A short account of the most characteristic changes in the dog, described by Von Anrep, will

enable us to better understand the effects produced on the human subject, which do not yet seem to have received the consideration they deserve.

*Dogs* (eight experiments).—Even doses of 0·005 gram per kilogram give rise to slight toxic phenomena. The dog becomes restless and excited, and keeps running about and barking. The pupil is dilated. All these symptoms are of short duration, and vanish completely in half-an-hour.

Passing over the effects of intermediate doses, characterised by a longer period of seemingly pleasurable excitement, it is found that with doses of 0·015 gram per kilogram immediate toxic effects are produced. The whole aspect of the dog is suddenly and visibly altered. It remains standing on one spot in apparent anxiety. It seems no longer able to recognise the persons around; it becomes restless and trembles violently. Continual pendulous movements of the head from right to left ensue and increase in intensity, as also do the tremors of the whole body. Inspiration is strongly accelerated, the pupils are dilated, the skin is quite hot, and the mucous membrane of the mouth dry. This condition lasts from fifteen to twenty minutes, when it suddenly changes to a state of pleasurable excitement, during which the animal runs about and wags his tail. This stage lasts from ten to twenty minutes, when a further change takes place. The animal seems rooted to one spot, and when

called upon, despite his apparent willingness to obey, appears unable to answer the call.

These phenomena last from three to four hours, when the dog gradually becomes quieter, its respiration normal, the raised temperature of the skin falls, though a little fatigue and sleepiness still remain.

A larger dose, 0.02 gram per kilogram, produces more intense symptoms of a similar kind. Of these we need only note the loss of equilibrium and of power over the muscles of his limbs, and the laboured breathing. In twenty to thirty minutes after injection, violent convulsions, prolonged swimming-like movements of the hind legs, opisthotonos, irregular respiration, loss of consciousness, are all present and last about an hour, when the usual fitful signs of recovery begin to appear. Dejection, sleepiness, want of appetite, and indifference to everything mark the final stages of recovery. Dogs are found to vary in the degree of their susceptibility to the effects of cocaine.

A few remarks on the action of cocaine upon some individual organs and functions merit our consideration.

1. *The Brain and Spinal Cord.*—From observations of the general phenomena in all animals, we have experimental proof that the action of cocaine is especially directed upon the nervous system, and produces great changes in psychical functions and manifestations. The heightened reflexes, the



enormous accelerations of the respiration, and of the heart activity, the pendulous movements of the head, the swimming motions of the extremities, the difficulty to retain the equilibrium, the lack of co-ordination, the convulsions, and the irregular spontaneous muscular contractions, all prove that the cerebellum, the medulla, and the spinal cord are all more or less affected by cocaine. Experiments in which the spinal cord was severed, show that the convulsions are instantly suppressed by section of the cord at the level of the medulla oblongata, and are not produced at all by cocaine injections after section. Section at the sixth dorsal vertebra suppresses only the convulsions in the posterior, and not those in the anterior extremities.

It is evident, therefore, that cocaine has a distinct action on the brain. That the spinal cord itself is influenced is shown by the fact that after section its reflex action is increased.

2. *Respiration*.—In dogs small doses produce acceleration of the respiration; while medium doses quickly lead to a very great acceleration interrupted by brief periods of cessation. After each cessation the animal inspires deeply and slowly, then more and more swiftly and superficially until another period of cessation occurs. Large doses, after a period of acceleration, lead to a serious dyspnœa, or even to complete arrest of respiration.

Death from cocaine in warm-blooded animals occurs by paralysis of the respiration.

3. *Heart* (eight experiments, Von Anrep).—Small doses do not affect the heart; medium doses cause a strong acceleration of the heart contractions. In dogs the pulse may be three times the normal, though the normal form of the curve is unaltered and the beats are not weakened.

Large doses result in a slowing of the pulse, and of the contractions of the heart. Complete cessation does not occur, the heart still continuing to beat even after arrest of the respiration.

The inhibitory action of the vagus on stimulation of the nerve in the neck is lowered by small and completely paralysed by medium doses.

4. *Blood Pressure*.—The changes produced in the blood pressure belong to the most important phenomena produced by cocaine. Medium doses are followed by a very considerable increase of blood pressure; and large doses, after a temporary increase, by a rapid fall almost to the zero point of the blood pressure.

5. *Peristaltic motions in the Intestines*.—Adopting Rossbach's method of examination of the abdominal cavity, Von Anrep observed that medium doses provoke intense movements of the small intestines, and also increase those of the large intestines.

By contraction of the blood vessels the intestines

become pale and energetically peristaltic for some five to ten minutes, after which the vessels dilate and the peristalsis becomes weak or ceases completely.

Large doses intensify this action, while the vessels become gorged with venous coloured blood.

6. *The Pupil*.—In all warm-blooded animals, without exception, mydriasis was observed as the result both of local application and of administration by injection.

The dilatation of the pupil may last from one hour to two days, according to the dose, and is one of the last symptoms to disappear.

7. *Salivary Secretion*.—Contrary to previous observers, who ascribed the production of an increase in the mucous secretion, Von Anrep invariably noticed a decrease or drying up of the same, though it did not last long. He describes it as similar to that produced by administration of atropin. From several observations on man, it is quite certain that a cessation of the salivary secretion frequently, if not constantly, follows the injection of even a small dose of cocaine; therefore it may seem to act by paralysis of the secretory nerves, as atropin does. It might, however, possibly be due to its known power of constricting the calibre of the blood vessels.

*Observations on Man*.—Having prepared ourselves by this description of the principal toxic



effects of cocaine on the lower animals, I shall now ask your earnest consideration for a series of cases showing the action on man, and the frequency of disagreeable, if not injurious, toxic symptoms. My record differs so materially from the experience of those dental practitioners who have so warmly advocated the use of cocaine by injection, and from the recorded results of M. Viau, that I must exclude the purity of the drug from cavil by saying that the preparation used was the now familiar 1 grain tubes of cocaine hydrochlorate, sold at the dental depôts, and except in the first few cases the solution was freshly made each time with distilled water.

In each case a local application of a 20 per cent. solution was made to the gum to relieve the slight pain of inserting the point of the syringe.

From the very first I recorded the effects on the pulse, simply with a view of determining the changes in its character, and if possible to find an indication as to the best moment for operation.

In June last I was fortunate enough to interest a very nervous and apprehensive patient for whom I had several operations of a painful nature to perform. He is a well-known scientific chemist, and experienced and careful observer, as his notes on his experiences show, and I cannot do better than give you these in his own words.

CASE I.—*Extraction of Tooth.*—June 19th, 1886.

Quantity of cocaine injected, about  $1\frac{1}{2}$  grains. "Immediately after injection of the cocaine I felt very slightly faint and giddy; this soon passed off, and was succeeded by a slight numbness in the arms and hands, and a more marked numbness in the jaw. After a time, perhaps five to eight minutes, a difficulty in swallowing saliva was experienced; this continued until after the extraction had been made; a very feebly marked uneasiness in the region of the heart was felt. I had no inclination to drowsiness; on the contrary I had a most lively interest in the procedure, and was perfectly, even vividly, conscious of everything around me. A decided tendency to talk about the operation manifested itself. I almost regarded myself as some one else, on whom an interesting experiment was being performed, and I felt pleased to be present at the operation. When it was proposed to take out two stumps on the other side of the jaw without cocaine injection, for a moment I hesitated, but my anxiety to compare the pains of the two operations very quickly induced me to regard this part of the experiment with considerable interest.

"About ten minutes after the injection the pulse was about 90 to 93; two-and-a-half hours after the operation it was 90; four hours after the operation it was 75; my pulse is normally about 72 to 74.

"I had almost no abnormal sensation of any kind

after the operation, perhaps a very slight sickness for a few moments, and a disinclination to eat (the operation was performed about 1.20, and I had had no food since 9 o'clock).

“The operation was not painless, but the pain was small and decidedly less than that felt when the two stumps on the other side of the jaw were extracted. The pain was very local, no shock or wrench to the whole system was felt.”

“CASE II.—*Nerve destroyed*.—June 24th, 1886. Quantity of cocaine injected, about 1 grain. The injection was almost immediately followed by slight drowsiness; after two or three minutes this gave place to vivid consciousness of all surroundings and a feeling of great interest in the operation. About eight minutes after the injection the pulse was 96. No after effects of any kind were experienced, no difficulty in swallowing saliva, little or no numbness in the jaw; the slightly excited state wore off, and in the course of about an hour everything seemed to be normal; unfortunately the pulse was not observed after the operation. The operation was almost absolutely painless.

“CASE III.—*Stopping Sensitive Teeth*.—Saturday, June 26th, 1886. Quantity of cocaine injected, about 1 grain. Symptoms exactly as described on Thursday, also sense of security, of conviction that no great pain would be felt, was marked. Eight minutes after injection pulse was 96; ten minutes



after, 102; forty minutes after, still 102; sixty minutes after, about 100 (operation lasted about sixty minutes). One-and-a-half hours after injection, pulse was 86; two hours after, still 86; three hours after, 73.

“No loss of appetite or feeling of sickness was felt to-day or on Thursday.

“CASE IV.—*Fixing Pivot Teeth*.—Saturday, July 10th, 1886. Injection was made after one tooth had been fixed, the operation having lasted about one hour. Pulse before the injection, 85.

“Immediately after the injection I felt a very slight, almost inappreciable faintness: no numbness in the jaw, or difficulty in swallowing saliva. The slight faintness quickly disappeared; eight minutes after the injection the pulse was 83 to 84; ten minutes after, 82 to 83. As I was experiencing none of the effects which had formerly followed after the injection of cocaine I began to think that enough had not been given, or that the liquid had not penetrated the tissues properly. Dr. Cunningham had left the room, so that I could not ask him anything about the quantity injected. Fifteen minutes after injection the pulse was 82 to 83, all abnormal sensations were absolutely non-existent, but the pain caused by the injection-syringe was very perceptible. I now began to suspect that Dr. Cunningham had not injected any cocaine. When he returned, twenty minutes after the injection,

and asked me how I felt, my suspicions were confirmed. No cocaine, only water, had been injected.

“I had not the slightest notion or suspicion at the time of the injection that cocaine was not being used.”

“CASE V.—*Fixing Pivot Teeth*.—Saturday, July 10th, 1886. Quantity of cocaine injected, about 1 grain. Pulse before injection was 82 to 83. Immediately after the injection slight drowsiness and faintness were felt. The faintness increased and was more marked than on any former occasion. Eight minutes after injection pulse was 85; about ten minutes after injection faintness began to pass away, and was succeeded by the usual vivid consciousness, great interest in the operation, and feeling of security. Twelve minutes after injection the pulse was 107, the jaw felt slightly numbed, and there was some difficulty in swallowing saliva. Forty minutes after the injection the pulse was 100, one-and-a-half hours after, 92; two-and-a-half hours after, 86; three hours after, 75. A swelling was produced in the upper lip: this had subsided about three hours after the operation. In less than an hour after the operation all my sensations were normal; there was no loss of appetite, or indeed any appreciable after effects of any kind. Fixing the teeth was performed without any pain.

“*Conclusions*.—It seems to me that after cocaine

injection, two periods are to be noticed. The first extends, in my case with an injection of about  $1\frac{1}{2}$  grains, through an interval of some five to eight minutes; the pulse is only slightly quicker than usual, there is a feeling of slight drowsiness and faintness. The beginning of the second period is marked by the disappearance of drowsiness and faintness, and by a great increase in the rate of the pulse, then follows a feeling of vivid interest in the proceedings, great mental clearness, and a sense of security from pain. The second period lasts, in my case, for something like an hour; after that I have returned to my normal state, except that the pulse is still quick; the pulse does not become normal until about three hours after the injection."

I trust you will absolve as readily as did the patient, the deception practised in Case No. 4. After the remarks of Mr. Smith Turner, in a discussion on cocaine in the *Casual Communications* exactly a year ago, I felt that some such experiment was necessary to prove that the results were not obtained merely "by working on the imagination."

Even in this apparently successful subject, the toxic phenomena were well marked, but not intense, and included faintness and giddiness, numbness in the extremities, difficulty in swallowing, uneasiness in the precordial region, marked loquacity, and a considerably accelerated pulse,



with the after effects of nausea and a disinclination to eat on the first occasion.

The only other detailed cases with which I shall trouble you are an extremely interesting series of observations on a patient, an active dental practitioner, familiar with the action of the drug, and who, after the first disagreeable, if not serious effects of the first administration, courageously volunteered to undergo a second administration with a view of ascertaining how much the susceptibility of the same individual may vary at different times, or how far the individual affected by serious symptoms may tolerate a further exhibition of the drug.

In a previous case (No. 14), where the symptoms had been much more serious, I was prevented employing it a second time by the express disapproval of two medical men who saw the patient, despite the desire of the latter to take it again. Our confrère, knowing all this, is all the more to be complimented on his determination and courage in offering himself for experiment.

CASE 23.—*T. F.*, March 14th, 1887.—After sub-mucous administration of one grain of cocaine hydrochlorate on the outer side of the right ramus of the lower jaw, there soon appeared symptoms of a general nature, evidently due to the systemic absorption of the drug. The patient is a well-developed, muscular young man, with no

constitutional or hereditary tendencies of a marked character, and to whom the drug was administered to relieve inflammation of the root of right lower bicuspid, with subsequent swelling of the corresponding cheek.

In the course of a minute or so the facial expression changed from a quiet state to a fixed staring, with widely dilated pupils, as if some danger was impending. In five minutes the acute pain in the part had entirely disappeared, so much so that the patient was able to close his jaws vigorously, despite the inflamed periosteum. In eight minutes there occurred a feeling of weakness which I was unable to define precisely. It was complained of in the precordial region, and became so great that the patient cried out, "Oh my heart!" at the same time placing his right hand over the precordial region. He complained of great dryness of the mouth and difficulty in swallowing, which was seen to be due to an arrest of the salivary secretion. The usual loquacity was especially noticeable in this usually remarkably quiet individual. The loquacity increased till it soon reached its maximum, when the movements of articulation began to fail and an indistinctness arose in his speech. During this very loquacious period it became quite evident that his articulatory movements could not keep pace with the production of ideas. This passed off rapidly and was replaced by silence,

with no desire to express his own ideas and views, if he had any. The staring, somewhat wild expression still persisted. On being asked questions he evidently did not care to be troubled, and answered in the shortest way possible. Marked intolerance of light now came on, which, however, had existed to a certain degree from the beginning. A dryness of the mouth and fauces was complained of, but he had arrived at a stage when he did not care either for himself or his surroundings, and preferred to be left alone in his drowsy state. He was now placed in the recumbent from the sitting posture. On first being placed on the sofa he had an attack of restlessness which he was so unable to control that he rolled off. Then the respiration became more irregular and laboured for a time; while in seventeen minutes the patient complained of tingling sensations in his fingers. He had alternate loquacious and silent fits. In twenty-four minutes the tingling sensations ceased. After which he became more drowsy and resented being asked any questions or troubled in any way, with very marked intolerance of light—in fact, so much so that he expressed a desire to put down the gas or have something over his eyes. In forty-five minutes he complained of a very uncomfortable sensation of depression and heaviness in the abdomen. He also felt that he would like to tell us a great deal about his ex-



periences, but try as he would he was unable to do so. After remaining in this state some little time he passed into another state, characterised by great personal confidence in being able to do this or that and by his brightening up a little. His expression now was somewhat dull, stupid, and vague, and on getting up he did not seem to be well able to co-ordinate his muscular movements.

At this time he was shown various articles in the room, together with some coins, and although he recognised them he was considerably puzzled to give the name, at first giving the wrong name, then it took him a long time to give the right one; this soon passed off. At the end of this stage he could easily write his own name without any difficulty. Now, almost three hours after injection, he only managed to walk home, half a mile, with help. He remained quiet the rest of the evening, and had no desire to take food, although he had not had anything since lunch, 1 p.m., that is, after a fast of seven-and-a-half hours.

CASE 24.—*T. F.*—10 and later 5 minims, 10 per cent. solution, cocaine hydrochlorate for extraction and replantation of left lower second molar.

P.M.	PULSE.	
5.50	72	Injection.
5.51	108	Paleness of face.
5.53	..	Constant swallowing. Deep inspiration. Pulse weaker.
5.54	120	Intestinal movements complained of.
5.55	120	Pupils slightly dilated—respiration normal—pulse weaker but regular. Loquacity first noticed.
5.58	..	Pupils moderately dilated—difficulty in articulation. Tremors well marked. Spontaneous movement of limbs, especially of left leg.
6.0	120	General restlessness. Conscious of oppression in respiration. (Patient wanted collar loosened which was already quite loose, therefore no necessity to undo it.) Difficulty in finding words to express, but none in articulation. Pupils more dilated.
6.3	128	Part of gum injected sensitive to touch. Deep inspiratory movements at intervals, with intervening quiet periods of respiration.
6.5	128	
6.6	..	Pulse still weak and rapid.
6.8	..	Feels very tired—deep inspirations going on.
6.10	104	Deep inspirations more pronounced—pulse weak.
6.12	..	Sensation complete in part injected.
6.18	100	Patient beginning to become quiet—somewhat drowsy, with fixed expression.
6.20	100	Drowsy—entire loss of interest in his surroundings.
6.22	..	Pupils slightly smaller. Pulse not so rapid, and a little stronger.
6.25	84	No desire to answer questions.
6.30	..	Inspiratory movements not so pronounced—marked dryness of mouth.
6.32	72	Pulse as before injection—not quite so strong. Restlessness of extremities. Expression normal. Palidity disappeared. Patient felt quite right, only slightly fatigued.
		Patient says that during the last ten minutes he had a large number of ideas with a great desire to express them, but could not do so.
		Parts where injection was made hypersensitive.
6.45	88	Half grain of cocaine administered at the special request of the patient.
6.46	108	Characteristic respiration—pale. Same expression as before, only in a slighter degree.
6.46 $\frac{1}{2}$	..	Tooth replanted.
7.0	72	Pain very marked on pressing replanted tooth.
7.5	..	Two cups of tea administered with distinct effect. Return of loquacity and great desire to impress upon us the inutility and inadvisability of using cocaine injections in dental practice.
7.30	..	Patient walked home entirely without help or assistance—quite a contrast to the previous occasions. Patient desirous of eating.

P.M.	PULSE.	
8.0	..	Dinner—but did not eat much. Replanted tooth did not hurt him much.
8.45	..	Patient rose from the table—became drowsy, then cross and disagreeable—lay staring in a limp condition on the sofa, oblivious and indifferent to his surroundings. Although an inveterate smoker he could not be induced to try a smoke.
9.0	..	Tea administered, with marked beneficial effect, which soon banished a troublesome headache.
9.15	..	Patient smoked a cigarette with pleasure. The patient passed a somewhat sleepless night, and was greatly depressed all the next day.

These two cases have been fully reported, not because they happened to present the most serious phenomena coming under my observation, for you will see from a reference to the Tabulated Record of Cases that No. 14 was much more grave, but because the patient allowed us to treat him as the subject of a physiological experiment.

*Tabulation.*—The Tabulated Record of Cases I now present has some features which I think cannot fail to arrest your attention, especially that of those who are desirous that this Society should give a decision approving of the administration of cocaine by injection. A careful perusal of that table will be more eloquent than any words of mine, therefore my remarks on these observations shall be as brief as possible.

*Condition of Patients.*—The omission of a column for “temperament” may be remarked. The untrustworthiness of a diagnosis of this kind by a



specialist such as a dental practitioner would render it of little or no value.

All the patients, with the exception of two, were strong, healthy young adults, or men in the prime of life. Of these two exceptions, the one, Case 12, is a confirmed invalid; the other, Cases 9-11, was not allowed by her medical attendant to take nitrous oxide, ether, or chloroform, on account of her bad state of health, yet, contrary to what might have been expected, the constitutional symptoms were in these cases the least noticeable or serious of all those observed.

The nervousness of the patient seems to be no indication that the effects of the drug will be either more marked or slighter than in ordinary cases. Case 14, in which the toxic effects were most marked, is that of an extremely nervous man, and may be contrasted with the stolid temperament of the subject of Cases 23 and 24, where the effects were, indeed, sufficiently serious. The subjects of Cases 9-11, and 1-5, were both extremely nervous individuals, and yet gave perhaps the most, indeed almost the only really successful results.

Examine the pulse column, note the men with pulses about or over eighty, they were all very nervous; the one great exception was the nervous vegetarian (Case 27), with a pulse of 74. Von Anrep concluded that the carnivora exhibit a greater susceptibility to the action of cocaine than

the herbivora. Our human vegetarian, however, presented no lesser degree of susceptibility than the flesh-eaters.

*Dose and Effect.*—It is interesting to note the lack of any constant relation between the amount of the dose and the effect produced. The largest dose ( $1\frac{1}{2}$  grains), in Cases 1 and 9, produced good results; the medium dose (1 grain), in Case 14, the very worst, and the minimum dose ( $\frac{1}{2}$  grain), in Cases 6 and 18, one or more attacks of faintness, and in Case 25 spontaneous muscular contractions. To see the varying effects of the same dose on the same individual at different times, compare Cases 23 and 24, also 2 or 3 and 5.

In Case 6, a second dose of  $\frac{1}{2}$  grain increased the pulse to 120 in twenty-four minutes, while the previous greatest acceleration was 112 in ten minutes; whereas in Case 27, nearly the same dose added to the  $\frac{1}{2}$  grain dose within six minutes, neither increased nor diminished the rapidity of the pulse (120). Further notes on the effects of repeated doses on the pulse would be interesting.

From Cases 20, 25, and 26, it would seem that the addition of 2 per cent. of carbolic acid to the solution of cocaine does not, as claimed by M. Viau, materially alter the local or constitutional effects produced without that addition.

It is worth noting, too, that in his own cases he ascribes any faintness or after trouble to emotion,

and not to any action of the drug, while in those of Herr Telschow he lays all the blame on the drug.

*Operations and Results.*—With regard to the operation performed or desired to be performed, and the result obtained, a more accurate estimate is formed by a consideration not of the number of cases, but of the number of individuals treated. In endeavouring to gain a knowledge of the physiological action of the drug on man, we must regard the results of observation in this way.

The results of the operation of extractions show that in four individuals (Cases 1, 8, 9, 10, 11, 26) pain was felt, but it was not great. The drug gave them resolution and fortitude.

Case 6 was a similar one, except that the toxic effects were too serious to merit it being termed even a qualified success. In four individuals (Cases 12, 16*a*, 22, 24) no diminution of sensibility whatever was produced.

For extirpation of the pulp it was a success in Case 2, while in three individuals (Cases 16, 19, 14) it failed to relieve the pain at all, or it was impossible to operate.

For the excavation of sensitive dentine, in two individuals (Cases 3, 15) there was no great pain, and the patients felt their powers of endurance increased; while in two individuals (Cases 20, 21) it was an absolute failure.

On analysis of the other cases, it will be seen



that in cases of severe pain from acute periostitis, the injection relieved the general neuralgic pain (Cases 7, 13, 20, 23). As a rule neither the general nor the local effect is sufficiently great to relieve the periosteum from pain on pressure (Cases 6, 7, 13, 25, and 26). Where the constitutional effects are serious, as in Case 23, there is complete anæsthesia of the periosteum.

*Pulse.*—The length of time taken by the pulse to reach its highest point of acceleration varies greatly in different individuals, without bearing any relation to the amount of the drug exhibited, or giving any trustworthy indication as to the best moment for operation.

The period of time necessary for a return to the normal, varies in a similar manner within even greater limits.

In Cases 1, 2, 3, and 5, doses on the same individual, repeated at some days interval, show a continual increase of acceleration, and, curiously enough, the first and largest of the doses gives the least acceleration. Relatively the larger doses do not seem to accelerate the pulse so much as small doses. The greatest increase observed was 56 beats to the minute, with a dose of 10 mimims (Case 24), reached in 13 minutes, causing no faintness; while the smallest increase was 8 beats with the same dose within 10 minutes, causing a severe fainting attack (Case 13).

The pulse gives no certain indication of the best time to execute a short and painful operation.

*Subjective Phenomena.*—The subjective phenomena observed included “light-headedness,” giddiness, faintness in all degrees, uneasiness in the precordial region, intolerance to light, tingling sensations in extremities, and irritable sensations of the skin. The frequency of these is remarkable. Out of nineteen individuals, only three (doses  $\frac{1}{2}$ , 1, and  $1\frac{1}{2}$  grs.) presented no subjective phenomena. These three patients included the two invalids. In the remaining sixteen cases, where the phenomena were more or less marked, several were sufficiently severely attacked, mostly from faintness, so as to preclude the execution or progress of the operation.

Dr. Sandré, of Vienna, has recorded some cases in which injection of cocaine produced very extraordinary effects by excitation of sexual desires, manifested by objective phenomena. It is interesting to note that in the course of an hour after injection one of my patients says that it had a marked aphrodisiac effect upon him.

*Objective Phenomena.*—The objective phenomena observed included the characteristic change in respiration already referred to, irregular spontaneous muscular contractions, even amounting to convulsions, partial loss of power and lack of co-ordination of muscular movement, the cessation



# RECORD OF CASES IN WHICH A TEN PER CENT. SOLUTION OF COCAINE HYDROCHLORATE WAS HYPODERMICALLY INJECTED FOR DENTAL OPERATIONS.

UNIVERSITY  
OF PENNSYLVANIA

Case No.	Date.			Name.	Sex.		Approximate Age.	Condition of the Operation Field.	Minims Injected.	Operation Performed.	Result.	Observations on the Pulse.			Subjective Phenomena.	Objective Phenomena.	Mental Changes.	REMARKS.	
	Y.	M.	D.		M.	F.						Before Injection	Acceleration.						
													Time.	Degree.					Relative Increase.
1	1886	VI.	19	M. M. P. M.	1	—	38	Carious left lower M <sub>3</sub> .. ..	15	Extraction ' .. ..	" Not painless, but pain small " ..	82	10 min.	93	11	Slight faintness and giddiness; slight numbness in arms and hands, great numbness in jaw; slight uneasiness in precordial region; difficulty in swallowing.	Cessation of salivary secretion .. ..	Vivid interest in the operation; increased mental clearness; loquacity very marked.	Normal pulse 72.4. After-effects, slight nausea and disinclination to eat; pulse normal in four hours.
2	"	"	24	" ..	"	—	—	Carious left lower B <sub>2</sub> .. ..	10	Pulp extirpated .. ..	Almost painlessly .. ..	82	8 min.	96	14	Similar, only very slight .. ..	None .. ..	Drowsiness, followed by vivid consciousness.	No after effects.
3	"	"	26	" ..	"	—	—	Very sensitive caries in upper left incisors.	10	Cavities excavated and filled	"No great pain " .. ..	83	10 min.	102	19	" ..	" ..	" ..	No after effects, operation lasted one hour; pulse normal in three hours.
4	"	VII.	10	" ..	"	—	—	—	None, water only.	—	No effect .. ..	85	15 min.	82-3	-3-2	Very slight faintness .. ..	" ..	None ..	Patient ignorant of the fraud.
5	"	"	"	" ..	"	—	—	Sensitive upper right incisor roots.	10	Fixing porcelain crowns ..	No pain .. ..	82-3	12 min.	107	25-4	Faintness more marked; jaws slightly numbed and difficulty in swallowing.	Cessation of salivary secretion; swelling of upper lip, which subsided in three hours after the operation.	Drowsiness, followed by vivid consciousness.	No appreciable after effects; pulse normal in three hours.
6	1886	VII.	24	Miss S. ..	—	1	30	Acute periostitis of upper right canine (root).	5	None .. ..	Gum insensitive, but root sensitive to percussion.	85	10 min.	112	27	Faintness .. ..	Sobbing, lachrymation, and laboured respiration.	None observed.	
"	"	"	"	" ..	—	"	"	" ..	5	Extraction .. ..	"Very little pain " .. ..	?	5 min.	120	?	Second fainting attack .. ..	Restlessness of head and body .. ..	" ..	Second injection nineteen minutes after the first.
7	1886	VII.	29	F. G. H. ..	1	—	21	Upper right first molar, acute alveolar abscess.	6	Exploration, &c. .. ..	General pain ceased with injection	72	13 min.	106	34	Patient felt warm and lively ..	None observed .. ..	Usual loquacity .. ..	The operation was rendered extremely difficult from the irregular position of the second bicuspid, which it was desirable should not be injured.
"	"	"	"	" ..	"	—	"	" ..	8	Crown fractured (3 teeth in a clump).	Tooth sensitive to pressure.. ..	84	20 min.	100	6	Patient "felt queer about the temples."	" ..	" ..	} Three hours interval between second and third injections.
8	"	"	"	" ..	—	"	"	" ..	8	Difficult extraction (3 roots)	"Very little pain" .. ..	74	15 min.	108	34	Giddiness .. ..	" ..	" ..	
9	1886	VIII.	2	Mrs. M. ..	—	1	45	Lower left I <sub>1</sub> ; right I <sub>1</sub> , I <sub>2</sub> , B <sub>1</sub> , B <sub>2</sub> and two molar roots, decayed and loose.	15	Easy extractions .. ..	"Felt extractions, but not much pain."	96	15 min.	112	16	None .. ..	None .. ..	Loquacious and very confident, instead of very despondent as before the injection, dread and fear quite disappeared.	Patient felt as "if she had had a glass of champagne." One half of drug injected anteriorly, the other posteriorly (bicuspid region). Patient in very poor health.
10	"	"	5	" ..	—	"	"	Upper right I <sub>1</sub> , I <sub>2</sub> , C, (M <sub>1</sub> , M <sub>2</sub> roots).	12	" ..	" ..	—	—	—	—	" ..	" ..	" ..	" ..
11	"	"	11	" ..	—	"	"	Upper left I <sub>1</sub> , I <sub>2</sub> , C, and M <sub>2</sub> ..	12	" ..	" ..	—	—	—	—	" ..	" ..	" ..	" ..
12	1886	VIII.	2	Mrs. C. ..	—	1	55	Lower right B <sub>1</sub> , periostitis ..	10	Easy extractions .. ..	"No diminution of sensibility" ..	similar to others,	record lost.		None .. ..	None .. ..	Slight loquacity " ..	A confirmed invalid; operation at patient's house with her medical attendant.	
13	1886	VIII.	5	Rev. R. ..	1	—	40	Upper left I <sub>1</sub> , acute periostitis.	7	None .. ..	General pain relieved, but tooth sensitive to the slightest pressure.	72	10 min.	80	8	Great faintness, general feeling of cold; precordial uneasiness.	Profuse perspiration; great trembling in the extremities.	Usual loquacity; disturbed about his next sermon.	It was impossible to carry out the intended operation, viz., opening up pulp cavity to remove the irritant.
"	"	"	"	" ..	"	—	"	" ..	10	" ..	" ..	"	"	"	"	None .. ..	" ..	" ..	Second injection three-quarters of an hour after the first.
14	1886	VIII.	11	J. E. B. ..	1	—	21	Upper left B <sub>1</sub> B <sub>2</sub> , pulps exposed	10	None .. ..	Impossible to operate .. ..	76	20 min.	116	40	Immediate faintness, recurring faintings for one-and-a-half hours; severe pain in abdomen, also eyes, neck and head; general sensation of extreme cold.	Patient very restless, can't be still, convulsive movements; in twelve minutes numbness in left arm, then cramps in the abdomen; irregular and violent spontaneous muscular contractions left and then right arm, left and then both legs, amounting to convulsions; lack of coordination, and loss of power in lower limbs, hence inability to walk for fully two hours; severe spasmodic and laboured respiration at repeated intervals; chattering jaws.	Loquacity very marked at first; attacks of drowsiness. Patient didn't seem anxious about his alarming condition.	Salvolatile, and later brandy, administered on the fainting attacks recurring. The alarming effects lasted over one-and-a-half hours. In two hours a medical practitioner arrived; recommended hot mustard foot-bath and the patient to be put in bed. Patient walked, even with help, like a very drunken man, in two-and-a-half hours to a cab, was assisted home and treated as recommended. In six hours the doctor found him up and about again.



RECORD OF CASES IN WHICH A TEN PER CENT. SOLUTION OF COCAINE HYDROCHLORATE WAS HYPODERMICALLY INJECTED FOR DENTAL OPERATIONS—continued.

Case No.	Date.			Name.	Sex.		Approximate Age.	Condition of the Operation Field.	Minims Injected.	Operation Performed.	Result.	Observations on the Pulse.				Subjective Phenomena.	Objective Phenomena.	Mental Changes.	REMARKS.	
	Y.	M.	D.		M.	F.						Before Injection	Acceleration.							
													Time.	Degree.	Relative Increase.					
15	1886	X.	20	Miss M.	..	—	1	30	Very sensitive dentine..	10	Excavation .. ..	“Thought it helped me to bear the operation better.”	80	10 min.	98	18	Fainted .. ..	Hysterical .. ..	None observed .. ..	Patient under rubber-dam.
16	1886	X.	26	J. L.	..	1	—	22	Exposed pulp .. ..	10	Endeavoured to remove the pulp.	Failure .. ..	80	15 min.	100	20	Faintness and nausea .. ..	None .. ..	Usual loquacity.	
”	”	”	”	”	..	”	—	”	” .. ..	3	” .. ..	” .. ..	—	—	—	—	None .. ..	” .. ..	” .. ..	
16a	”	”	”	”	..	”	—	”	Lower right M <sub>1</sub> root .. ..	5	Extraction easy .. ..	” .. ..	—	—	—	—	” .. ..	” .. ..	— .. ..	
17	1887	I.	4	H. B. S.	..	1	—	25	Left upper I <sub>1</sub> root, acute inflammation of gum, fistulous opening.	10	Lanced gum and burred out abscess cavity.	Failure, except when operating on superficial layer of gums.	86	5 min.	100	14	Slight faintness .. ..	Passing tremors in left leg; usual dryness of mouth and fauces.	Usual loquacity.	In twenty minutes pulse normal and patient all right.
18	1887	II.	10	C. J.	..	1	—	30	Right lower I <sub>1</sub> , with painful swollen gum.	5	Lanced gum and burred out abscess cavity.	Superficial parts numbed, deeper extremely sensitive.	75	5 min.	84	9	Two fainting attacks .. ..	None .. ..	” .. ..	
19	1887	III.	12	S. H. F.	..	1	—	18	Right upper B <sub>2</sub> , exposed pulp..	8	Operation interrupted ..	Failure .. ..	70	15 min.	96	26	Fainted .. ..	Lachrymation .. ..	None observed.	
20	1887	III.	12	F. W.	..	1	—	23	Right upper M <sub>1</sub> , sensitive carious dentine.	7 (carbolised sol. 2%)	Tried to excavate the putrid irritant dentine.	Failure, but neuralgic pain relieved	70	15 min.	88	18	Faintness; great pain referred to lower external angle of orbit.	Tremors in both legs .. ..	Loquacity; “felt calm” .. ..	Acute pain on inserting dressing, although a 20% solution cocaine was applied locally for ten minutes.
21	1887	III.	21	Miss T.	..	—	1	23	Inverted upper central incisors	9	Wedging and excavation ..	“Could not have been more painful.”	80	30 min.	122	42	None .. ..	Characteristic respiration, hysterical; half-an-hour spontaneous muscular twitchings and cramp in lower limbs, cramped cold hands; one-and-a-quarter hour, found loss of power and lack of co-ordination in upper extremities.	In five minutes patient dazed, silent, staring, and could not answer either entreaty or threats, although most desirous of doing so.	In two hours co-ordination normal; after effects, malaise and disinclination to eat, although fasting.
22	1887	III.	31	E. R. H.	..	1	—	20	Fractured right lower M <sub>2</sub> , tilted and deep in ramus of jaw.	5	Extraction (very difficult and prolonged).	Failure .. ..	76	10 min.	90	14	None .. ..	None .. ..	None .. ..	“I won’t have cocaine again.”
23	1887	III.	14	T. F.	..	1	—	25	Right lower B <sub>2</sub> , acute periostitis with considerable swelling.	10	None .. ..	Complete loss of sensibility, and could clash his jaws together.	sphygmographic tracings taken				Precordial uneasiness and disagreeable sensations in the abdomen; tingling of fingers and intolerance to light; aphrodisiac effect.	Arrest of salivary secretion; respiration irregular and laboured; largely dilated pupil; lack of muscular co-ordination.	Loquacity very marked; great activity of idealisation centres; drowsiness, confusion of ideas.	After effects, disinclination to eat after seven hours’ fast; disturbed sleep; great depression all next day.
24	”	IV.	23	”	..	”	—	”	Left lower M <sub>2</sub> , very carious ..	10	Extraction .. ..	Distinctly painful .. ..	72	13 min.	128	56	Intestinal uneasiness .. ..	Dilated pupils; spontaneous muscular movements, especially left leg; respiration irregular and laboured.	Loquacity very marked; other symptoms similar, but not so marked as before.	“My second and last time of taking cocaine. I will never employ it in my practice.”
25	1887	IV.	29	W. B. A.	..	1	—	21	Right upper B <sub>1</sub> and B <sub>2</sub> roots; slight periostitis.	5 (carbolised sol. 2%)	Replantation .. .. Adjusting gold bands for porcelain crowns .. ..	Painful .. .. Both roots sensitive to the pressure.	72 60	1 min. 10 min.	108 104	36 44	Slight giddiness; tingling sensations, most intense in the fingers.	Complete cessation of salivary secretion; in 10 minutes, tremor in hands; in 12, spontaneous muscular contractions only in left hand; in 15, saliva beginning to flow; in 16, marked tremors in both legs for five minutes; in 23, involuntary contractions of extensors, opening closed left hand; in 30, no muscular contractions, only a shaky hand.	Marked loquacity; activity of idealisation centres.	“I shall always want cocaine in long dental operations.”
26	”	V.	2	”	..	”	—	”	Right upper B roots .. ..	10 (carbolised sol. 2%)	Extraction .. ..	” .. ..	60	8 min.	110	50	Numbness in extremities, tingling sensations.	Similar to 25, but more intense; general coldness of the skin; marked long-continued contraction of the erectores spinæ.	” .. ..	
27	1887	IV.	30	A. P.	..	1	—	20	Right upper M <sub>1</sub> , broken down roots.	5	None .. ..	None .. ..	74	6 min.	120	46	} Precordial uneasiness (slight) ..	In five minutes, cessation of salivary secretion, acceleration of respiration; slight muscular contraction in arms.	Loquacity as usual .. ..	
”	”	”	”	”	..	”	—	”	” .. ..	4	Extraction (difficult) ..	Painful .. ..	120	18 min.	”	0				

of the salivary secretion, profuse perspiration, and dilatation of the pupil.

The muscular phenomena are most frequent, and may be very serious, as in Cases 14, 23, and 24.

The restlessness affecting the head may be compared with the pendulous movements of the head produced by toxic doses in dogs and other animals. It is certainly of no aid or advantage in dental operations, and may be sufficient to prove a positive bar to their progress.

The dilatation of the pupil is not quite constant in man, which is seemingly a contradiction to Von Anrep's experience that it is constant in all warm-blooded animals. Possibly, though it is not so stated, he included the effects produced by local application, which would explain the difference observed.

The partial or complete cessation of the secretion of saliva is quite frequent, if not constant, and gives rise, doubtlessly, to the feeling of dryness in the mouth and fauces. This would therefore be a slight addition to the comfort of some patients in long operations, where the flow of saliva is often so excessive and discomforting.

Out of nineteen individuals, only in six were there no noticeable objective phenomena. From the observer being often engrossed in the dental operation, such phenomena may easily escape observation.



In at least three individuals the phenomena were decidedly serious, and one case (14) gave me more anxiety than I have ever had or hope to have in the whole of my professional experience.

It is important and curious to note that in some cases objective phenomena, such as cramps, tremors, cold "dead" hands, and even a general marked lowering of the temperature of the skin, gave rise to no unpleasant feelings, but often to quite pleasurable sensations on the part of the patient, probably owing to the exhilaration of the mental faculties.

*Mental Changes.*—The mental changes are curious, and seem to vary not so much with the amount exhibited, but rather with the degree of susceptibility of the individual. In favourable cases the drug merely acts as a cerebral stimulant, and, as these patients remark, it gives them the power to endure any pain incident to the operation. It gives resolution and fortitude to the irresolute. If we could so confine the action of cocaine it would indeed be a most valuable adjunct to the true anæsthetics. The very frequent indifference to surroundings and what is being done produced by this cerebral stimulation seems the main factor in explaining the so-called anæsthetic effect of the drug, and not so much the limited superficial anæsthesia produced by the direct contact of the drug with the nerve of the part through injection.



In the most severe cases, such as Cases 23 and 24, a very decided increase in the activity of the flow of ideas appeared, which soon passed away to be followed by a drowsy or sleepy state.

The loquacity frequently observed is very curious, but unimportant except as a sign of increased cerebral activity.

*Remarks.*—The after effects are slight or inappreciable in the majority of cases. Nausea, disinclination to eat, sleeplessness, constipation, and depression have been observed.\*

As restoratives, strong tea or coffee seem to recommend themselves more than amyl nitrite, nitro-glycerine, or alcoholic stimulants.

### CONCLUSIONS.

1. As a local anæsthetic, apart from its general effects, cocaine, administered by injection, destroys the sensibility of the nerves of the part in the immediate surrounding of the injection.

2. The nerve supply of a tooth being deeply situated is not affected by superficial injections under the mucous membrane.

3. Its general effects, by its influence on cerebral functions producing the symptoms already dis-

\* In my original notes I indicated the time allowed to elapse between the injection and the time of operation, also some other points, but I felt the table was already sufficiently complex, and no adequate gain was derivable from complicating it further.

cussed, seem to fully explain the successful results following its local injection.

4. Therefore the administration of cocaine by injection may have a limited field of usefulness in prolonged dental operations, preferably by small doses ( $\frac{1}{2}$  grain), repeated at intervals; even then, only to be resorted to in exceptional cases.

5. As an anæsthetic for the painless extraction of teeth, it is not to be compared with nitrous oxide, whether regarded as to its efficiency, its safety, or its certainty of action.

6. It appears from one case (No. 14) that very alarming results may attend the administration of even an ordinary dose to an apparently healthy individual, and further, it is not improbable that even greater injurious effects may be encountered with the extended use of cocaine administered by injection.

Cocaine, once thought to be isolated in the sphere of Pharmacology, is now known to have as analogues, brucine, and more lately, drumine. Whether they will have a more extended field of usefulness remains to be seen.

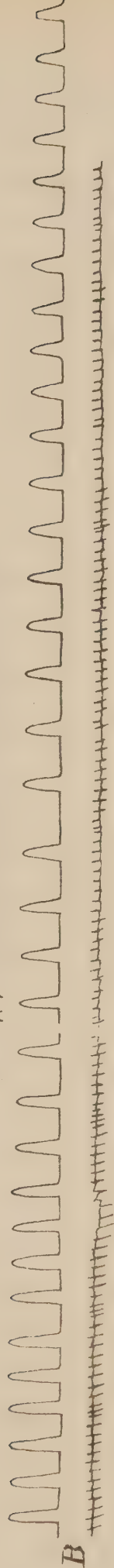
I cannot conclude without expressing my great obligations to Professor Roy for the experimental facilities afforded in the Pathological Laboratory of the University of Cambridge; to Mr. Griffiths, his Demonstrator, for most valuable help and assistance; and finally, to Mr. Faesch, for general assistance.



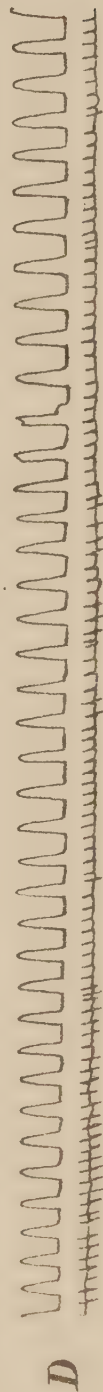


TRACES ILLUSTRATING THE DEPRESSANT ACTION  
OF COCAINE UPON THE HEART.

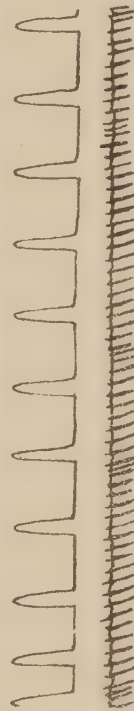
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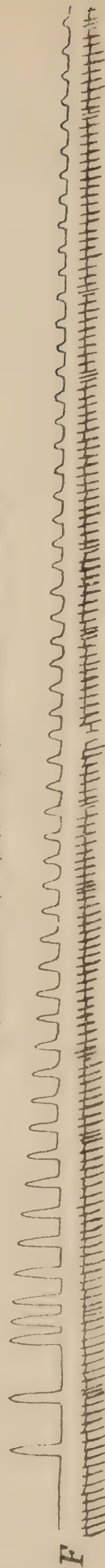
C



D



E



G



HEART TRACINGS UNDER COCAINE HYDRO-  
CHLORATE.

Taken by Dr. D. W. BUXTON.\*

- A. Represents the normal heart trace of a frog. The heart is excised, tied on a cannula, and a circulating fluid perfused through it. The apparatus employed is Roy's Tonometer, the trace being recorded on a revolving cylinder, the rate of whose rotations are given by the time-marking below.

The circulating fluid (Ringer) consists of a .6 % saline solution saturated with phosphate of calcium and with .75 c.c. of a 1 % solution of chloride of potassium added to each 100 c.c.

Dr. Ringer and the author have shown† that the frog's heart will beat for a very prolonged period if perfused with the above described circulating fluid.

- B. Added 1 c.c. of hydrochlorate of cocaine (10 %) to 200 c.c. of the circulating fluid—*i.e.*, 1 in 2,000.

The heart-beats at once grew weaker, and in about five minutes they were very feeble (*see* C).

The latent period was very markedly increased, and the heart's excitability to electrical stimulation as notably decreased. The "make" contractions also were abolished, while the "break" persisted.

- D. Shows that upon replacing the solution by simple circulating fluid, fairly rapid recovery obtains.
- E. Shows complete recovery of the heart after withdrawal of cocaine.
- F. To 200 c.c. of the circulating fluid, supporting the normal beat seen in E and beginning of F, .5 c.c. of cocaine hydrochlorate (10 %) is added—*i.e.*, 1 in 4,000. Immediately the heart-beat weakens and is finally reduced to the feeble contractions shown in trace G. The electrical changes mentioned above were again observed.

\* These tracings were, at the President's request, very kindly placed at the disposal of the Society by Dr. Buxton, who had brought them to the Meeting to illustrate some remarks on the action of cocaine on the heart, which he had intended making in the course of the discussion.

† "Journal of Physiology," Vol. VIII, No. 1, &c.

*Cocaine and its Use as a Local Anæsthetic in Dental Surgery.*

BY WILLIAM HERN, M.R.C.S. & L.D.S.ENG.

MR. PRESIDENT AND GENTLEMEN,

Among practitioners of surgery there has long existed a cherished dream of finding a reliable local anæsthetic. This desire has of late years been increasing in ever-widening circles in proportion to the growing demands and possibilities of modern surgery in its many branches. In no branch, however, has this solicitude for a local obtundent of pain been more marked and accentuated than in that of Dental Surgery, due, I imagine, in part to the very extended field of action which is there afforded to such an agent, but chiefly to a keenly felt necessity resulting from the lively and hyperæsthetic sensations of the great fifth nerve with which it has to deal. The numerous and various remedies which have from time to time been suggested and recommended to meet this craving, together with the fashionable demand which has greeted their *entrée* to the stage of Therapeutics, also demonstrates the universality of the desire of the profession to be free from an admitted *opprobrium* of their calling—the unavoidable necessity of inflicting pain.



The introduction of cocaine two or three years ago as an agent for producing local anæsthesia roused such widespread excitement amongst those engaged in the practice both of general and special surgery, that a sort of cocaine fever prevailed for a considerable time, which it has taken most of the intervening period to allay.

There seems to be a tendency during the feverish *furor* which frequently heralds the appearance of a new therapeutical remedy, to indulge in romantic fancies as to the virtues of the fledgeling, and to imagine that a panacea has been unearthed; a prognostication which later history and trial does not usually substantiate. It therefore becomes us now, after a fair period of probation of the drug cocaine, to sift and weigh the *pros* and *cons* of its action and uses, in order to confirm or modify any previous conceptions or conclusions as to its merits.

The opinions entertained as to the employment of cocaine, and the results that have been obtained by experiment or otherwise in its therapeutical application, which are scattered up and down throughout recent medical and dental literature, are so varied, and frequently so antagonistic and irreconcilable, that very many persons still remain in a state of suspended judgment as to the practical uses of the drug. With a view of assisting any who may be thus situated to come to a decision,

I propose to bring before you, in as condensed and epitomized a form as possible, some of the recorded successes on the one hand, and of failures on the other, and, with the results of my own experiments with the drug in a few cases, to draw such conclusions as these taken together may in my opinion justify.

Cocaine is obtained from the leaves of the *Erythroxalon coca*, a shrub cultivated on the slopes of the Andes, and in other parts of South America. The coca plant has been celebrated for many years amongst natives of South America as a medicine and a beverage, and seems to serve them as a substitute for the tea, coffee, tobacco, opium, &c., of other nations; the leaves, which are held in high repute by the Indians as a nutriment and restorative, are commonly used by them as a masticatory, and are considered absolutely essential for the endurance of fatigue and exertion. The alkaloid has a bitterish taste, and forms small colourless inodorous crystals; it has an alkaline reaction, and is soluble in 1 in 700 of water, 1 in 20 of alcohol, freely so in chloroform and ether, oils and fats. It is very sensitive to chemical and physical reaction, readily yielding derivatives; it melts at 98° C.

Its salts, of which the hydrochlorate and citrate are the chief for our purposes, are for the most part freely soluble in water.

The hydrochlorate is a white amorphous powder, freely soluble in water, spirit, and glycerine; insoluble in ether, fats and oils.

The citrate is found in small white deliquescent crystals, and readily dissolves in water and oils.

Before entering upon the more important and practical part of my subject, it will be instructive to review the physiological action of the drug with which we are dealing. In this connection the experiments of Dr. Mantegazza, of Milan, with infusions of the coca leaves on himself and other persons, will be interesting.\*

He found that an infusion of the leaves taken internally considerably increased the frequency of the pulse, being twice as powerful a stimulant as tea or coffee.

An infusion prepared from three drams of the leaves produced a feverish condition, with increased heat of skin, palpitation of heart, headache, noise in the ears, and vertigo; the pulse rose from 70 to 134, there was an apparent enlargement of the intellectual horizon, and a peculiar, hardly describable feeling of increased strength and impulse to exertion. An infusion prepared from four drams of the leaves produced a peculiar feeling of isolation from the external world, followed by one of general torpidity com-

\* *Pharm. Journ.*, 1860. *Ex. Oesterreichische Zeitschrift für Praktische Heilkunde*, November, 4, 1859.



bined with a feeling of intense comfort and an intuitive wish not to move about during the whole day; consciousness being all the time perfectly clear. After awhile sleep comes on, from which the patient awakes free from toxic symptoms. A dose prepared from 18 drams of the leaves produced a rapid rise in the pulse, followed by delirium; but after three hours' sleep Dr. Mantegazza was perfectly free from toxic symptoms, and could immediately follow his vocation without the least indisposition.

Dr. Hughes Bennett was, I think, the first in this country to extract the alkaloid, and to investigate its physiological properties in 1873.\*

After a careful experimental investigation into the action of theine, caffeine, cocaine, &c., he came to the conclusion that these principles were to all appearances identical in physiological action when administered hypodermically. His experiments were performed on warm and cold-blooded animals, and his conclusions are as follows:—

- I. In small doses not ending fatally it causes—
  - a. Cerebral excitement.
  - b. Partial general loss of sensibility.
- II. In doses subsequently fatal it induces prior to death—
  - a. Cerebral excitement.

\* Thesis to University of Edinburgh. *Edin. Med. Journ.*, October, 1873.

*b.* Complete general loss of sensibility.

*c.* Tetanic spasms and convulsions.

III. It destroys the excitability of the posterior columns of the cord, and the entire system of peripheral sensory nerves, but the anterior columns of the cord and the peripheral motor nerves remain intact.

IV. It causes spontaneous convulsions, but unlike those produced by strychnia, they are not excited by peripheral irritation, owing to paralysis of sensory nerves.

V. It first increases, then impedes, and lastly stops respirations.

VI. It increases, then finally diminishes, the force and frequency of the heart's contractions.

VII. It produces first contraction, and afterwards dilatation of the capillaries and small blood vessels, with stasis of the blood.

VIII. Special experiments proved that the nerve endings in skin and mucous membranes were rendered inexcitable, apart from any action the drug had on the nervous centres.

DR. HERMANN BIGGS, of New York, in an exhaustive Enquiry on the Physiological Action of Cocaine on the Frog, conducted under the direction of Professor Christiani, in the Physiological

Laboratory of Du Bois Raymond, at Berlin,\* concluded as follows:—That from the local and constitutional effects of cocaine on the different organs and tissues, it is highly probable that its general action is a purely local one, exercised on those parts for which it has a chemical affinity through the medium of the blood.

*On Respiration :—*

First increases the number of respirations, then decreases them.

In larger doses, death ensues from paralysis of respiration.

*On Heart :—*

Depressant action, reducing the force and frequency of pulsations, finally arresting auricles and ventricles in diastole.

*On the Nervous System :—*

Small doses heighten the irritability of sensory fibres, but exert no effect on motor filaments. It increases the irritability of the cord for a short time.

Large doses almost completely paralyse sensory filaments, and greatly diminish the irritability of motor filaments.

In 1 per cent. solution applied directly to the nerve trunks, it will, after a transient period of increased irritability, depress greatly and finally paralyse the nerve.

\* *Lancet*, January, 1885.



*On Voluntary Muscles:—*

Small doses have little effect on the excitability of voluntary muscles.

Large doses diminish their contractility very decidedly; contractions become shorter and more feeble; muscular excitability is soon exhausted.

DR. G. H. BEYER, in a valuable experimental paper on the Physiological Action of Cocaine,\* finds that Cocaine is exceedingly prompt and uniform in its effect on the heart.

- I. In small doses it is a powerful stimulant to the heart's action.
- II. In medium doses it has an inhibitory influence over ventricular contractions.
- III. In large doses it produces diastolic arrest.
- IV. In small or large doses it produces constriction of the blood vessels independently of the central nervous system.
- V. It produces a rise in the blood pressure succeeded by a fall.

GRUNHAGEN and BERTHOLD ascertained that the injection of cocaine in *moderate doses* increases the blood pressure, due, they believe, to the excitation of the vaso-motor centre, since it does not occur after section of the cervical swelling of the cord. In larger doses, a fall in the blood pressure

\* *M. T.*, November, 1885. *Ex. Amer. Journ. Med. Science*, 1885.

takes place, due to paralysis of the vaso-motor centre.

M. LABORDE,\* of Paris, in a report to the Biological Society on Cocaine, gives his results as follows:—

*On Nervous System.*—It acts apparently as a stimulus on the motor nerves, and with a contrary effect on the sensory.

*Circulatory System.*—Central and peripheral blood pressure is increased.

*Respiration.*—Respirations are quickened and very irregular.

*Reflex action* is unimpaired.

*Secretion.*—Very slight effect; urine lessened and secretion of submaxillary gland increased.

*Toxic effects* are very slight; very large doses must be given to determine symptoms of poisoning.

M. ARLOING, in his researches on the Physiological Action of Cocaine, concludes that hydrochlorate of cocaine is a purely local anæsthetic; contact of the terminal nerve plates with cocaine being the principal cause of anæsthesia.

PROFESSOR DA COSTA,† in a paper read at the Philadelphia College of Physicians in 1884, gives the results of his investigations on cocaine by

\* *B. M. J.*, January, 1885.

† *Med. Times*, November, 1885.

hypodermic injection, on a number of well and sick patients, the purport of which was as follows:—

No decided effect can be produced by any dose less than 8 minims of 4 per cent. solution (= about  $\frac{1}{3}$  grain of hydrochlorate of cocaine).

$\frac{1}{2}$  grain showed effects more strikingly.

$\frac{2}{3}$  grain was used in some cases.

The effects on the part injected depend upon whether the injection be superficial or deep-seated: if the former, local anæsthesia is produced; if the latter, local anæsthesia is not marked.

*Temperature* is raised  $\frac{1}{2}$  to  $1\frac{1}{2}$  degrees, the increase not taking place abruptly, and being maintained for several hours.

*Circulation.*—The pulse may be faster or slower, but invariably becomes fuller and stronger.

The character of the pulse was ascertained by many sphygmographic observations taken at intervals of fifteen minutes after the injection, the sphygmograph being kept in place to ensure uniformity. There was some general reduction of sensibility, whatever the dose employed, although not to any marked extent.

Professor Da Costa considers that the effect on the temperature and pulse recorded in these observations suggest the application of cocaine in many a condition of collapse, of weak heart, or heart failure.



MR. EBER CAUDWELL,\* of Westminster Hospital, in experimenting on himself with cocaine hydrochlorate taken by the mouth, records the effects as follows :—

$\frac{1}{2}$  grain produced some drowsiness.

1 grain produced sleep, followed by persistent insomnia.

$2\frac{1}{2}$  grains produced frontal headache, great mental excitement, and marked insomnia.

3 grains taken at 7 P.M., after abstaining from food for twenty-four hours, produced decided sleepiness and slight vertigo, which soon passed off, and he was fresh and well in an hour.

5 grains taken at 10.30 A.M. next day produced in a few minutes such giddiness that he could hardly stand. He felt unable to make any exertion, and suffered from supra-orbital headache, together with a sensation of weight and sinking at pit of stomach. The pulse, usually about 80, rose to 94. The temperature, taken four times, rose from 96·7 to 98·6. Pupils were widely dilated, and he could hardly see.

The unpleasant symptoms passed off in two hours, and he was able to walk to the hospital (four miles) in fifty minutes, at 1 P.M., when he remarks “felt quite myself again, and as vigorous as ever.”

Mr. Caudwell concludes that cocaine—

\* *B. M. J.*, January, 1885.

- (1) Exerts a double action on the brain :  
in small doses acting as a cerebral sedative ; in large doses acting as a cerebral stimulant.
- (2) That unless given in large doses it possesses no toxic action.

I gather from the foregoing and other experiments with cocaine the following summary of the physiological action :—

*On Heart—*

In small doses, powerful stimulant.

In medium doses, stimulation followed by depression.

In large doses, produces diastolic arrest of the heart.

*On Blood vessels—*

In small or large doses it produces at first constriction of the blood vessels, with a rise of blood-pressure, succeeded by a considerable fall.

*On Nervous System—*

Small doses increase the reflex irritability of the cord.

Large doses reduce it considerably.

*On Nerves* it appears to have the opposite effect of curare.

Small doses heighten the irritability of the sensory fibres, but exert no effect on the motor fibres.

Large doses completely paralyse sensory filaments and greatly diminish the irritability of motor.

*On Respiration—*

Moderate doses first increase and afterwards decrease the respiratory movements.

Large doses produce death from paralysis of respiration.

*On Voluntary Muscles—*

Small doses have little or no effect on their excitability.

Large doses diminish their contractility very decidedly, so that muscular excitability is soon exhausted.

*On Temperature—*

Slightly raised.

The following results of administration of large doses are interesting:—

Mr. Eber Caudwell (before mentioned) took by mouth 8 grains within twenty-four hours without serious results.\*

A correspondent to the *British and Colonial Druggist*, February, 1885, took 32 grains within three hours, succeeded by toxic effects which disappeared in twenty-four hours.

An apothecary† attempted suicide by taking 23 grains, and recovered without any bad effect being produced.

\* *B. M. J.*, January, 1885.

† *Varges Zeitchr.*



*Lancet*, November, 1886, records case of a patient, the subject of morphinism, who took 23 grains hypodermically in one day.

Professor Dieulafoy\* employed 48 grains, with success, as rectal injection.

On the other hand, Professor Kolomnin,† of St. Petersburg, had a fatal result of poisoning in a young woman, with 20 grains used as a rectal injection, and he is reported to have committed suicide in consequence.

*B. J. D. S.*, May, 1886, records a case from *Dental Register*, reported by Professor Doremus to New York Medico-Legal Society, of death from cocaine applied to relieve pain from decayed tooth; no dose mentioned.

The *British Journal of Dental Science* for April 15, 1887, reports, from the *Western Dental Journal*, another fatal case of poisoning by cocaine; but the relation between cause and effect seems to me so problematical that I hesitate to accept the conclusion.

As antidotes to the toxic effects of cocaine, the following drugs have been suggested:—Nitrate of amyl (3 minim capsules), nitroglycerine, bromide of potassium, &c. Coffee has also been recommended.

In its therapeutical action, with which I am more particularly dealing to-night, cocaine has brought forth some widely divergent opinions, and shown very varied results.

\* *B. M. J.*, November, 1886.

† *Ibid.*

In considering this want of concord in the opinions expressed, and want of uniformity in the results obtained, it would be well to bear in mind the following points, as they may perhaps assist in harmonizing some of the opinions and results which follow :—

- I. The sensitiveness of the drug to chemical and physical reagents.
- II. The varying degrees of action of the several preparations of the drug when applied to the same part, due to differing solubilities, menstrua, &c.
- III. The difference of result to be expected from the same preparation when differently applied therapeutically, &c.
  - (a) Whether used locally.
  - (b) Taken internally.
  - (c) Taken hypodermically.
- IV. The difference in time taken to produce anæsthetic effects according to the kind of therapeutical application, and the vascularity or non-vascularity of the tissue to which it is applied.
- V. The varying degrees of susceptibility of different persons to the drug.
- VI. The difficulty of eliminating errors in its use—*e.g.*, the liability to construe sequelæ as results, and to conclude that what is *post* is necessarily *propter*.

As a topical application for the production of local anæsthesia, in spite of the transient numbing action on the tongue pointed out by Dr. Niemann in 1860, and its action as a paralysing agent of the peripheral sensory nerves observed by Dr. Hughes Bennett in 1873, and Von Anrep in 1880, cocaine remained, as far as any practical use was made of its peculiar properties, obscure and unfruitful until 1884, when Dr. Köller, of Vienna, again brought the drug out of oblivion by advocating it as a local obtundent to the cornea and conjunctiva. Since then it has been very extensively used in ophthalmic practice, and has also been found to have a very pronounced anæsthetic action on mucous membranes, having been applied with varying degrees of success to nearly all the mucous tracts of the body.

Its action when applied to the skin is feeble and passing. As a surface application to the mucous membrane of the mouth, it has been used in solutions varying in strength from 2 per cent. to 50 per cent. or higher; the anæsthesia produced is a transient and superficial one, although dependent somewhat on the salt used, the strength of the solution, and the frequency of application.

The hydrochlorate is recognised as one of the most powerful salts of cocaine as a topical agent to mucous membrane, its action being much more



pronounced than that of the pure alkaloid. The most useful solutions are the 5 per cent., 10 per cent., 20 per cent., and 50 per cent. strengths.

In using cocaine as a surface application to the mucous membrane of the mouth, it must be borne in mind that the saliva may act as an effective obstacle to its full action, first by the washing away of the agent, and secondly by the interposition of a viscid layer of mucus between the drug and the end organs of the nerves.

I can do little more than enumerate some of the conditions and operations for which the surface application is useful, for many of which it has been recommended and used by various operators from time to time :—

The adjustment of clamps and separators.

- „ introduction of wedges.
- „ application of ligatures for the rubber.
- „ manipulation of deep cervical edges of cavities, whether for excavating, filling, trimming, or polishing.
- „ removal of tartar in *Pyorrhœa Alveoloris*.
- „ modelling of sensitive and irritable mucous membranes.
- „ lancing and excising gum tissue.
- „ opening of superficial abscesses and cysts.
- „ relief of pain after extraction.
- „ anæsthetizing pulps before extirpation.
- „ obtunding sensitive dentine.

And many other superficial operations on the oral mucous surfaces.

For some of the above operations I have found the drug to be a valuable obtunding agent. In a recent case of extremely irritable mucous membrane, where I wished to get models of a mouth in which half the maxilla had been removed by operation, I was enabled, after painting the surface with a little 10 per cent. solution, to get impressions without any difficulty, whereas I had before failed several times owing to the severe nausea and retching produced by the contact of the tray, &c. From the results in this case I think cocaine will be found to be a most valuable agent for procuring models for obturators, &c., where it would be impossible to get them without such an agent. A spray of 2 per cent. or 4 per cent. would also act well for this purpose.

For the relief of pain after extraction it cannot be relied on; recorded trials agree that weak solutions, as 2 per cent. and 4 per cent., are of no service, although better results have attended the use of stronger solutions. The obtunding effect, however, is so transient that its employment for this purpose is unsatisfactory, and the same may be said for the relief of odontalgia.

As an obtundent to sensitive dentine, experimenters do not agree as to results obtained.

Among the preparations suggested and used for the purpose are the following :—

The hydrochlorate in aqueous and spirituous solutions.

The citrate in paste and solution.

The oleate.

The pure alkaloid in paste, or essential oils, as oil of cloves, cajeput, or eugenol.

DR. MORGAN HOWE,\* in experimenting with 2 per cent. solutions for the relief of sensitive dentine, found that it manifested some anæsthetic effect, but gave no satisfactory results.

DR. C. F. IVES† says : “Successes and failures about equal,” most effective in teeth above mediocrity in quality and patients over twelve. In young patients with soft white teeth “no successes whatever.” 4 per cent. and 10 per cent. no more certain than weaker solutions.

MR. BOYD WALLIS‡ records results of trial of cocaine in seven cases with 25 per cent. and 50 per cent. solutions in spirit of wine and eugenol ; three of which were for sensitive dentine, and resulted as follows :—

In one, practically useless.

In second, excavation completed with trifling pain, after second application of cocaine.

In third, operation successful, without pain.

\* *Cos.*, December, 1884.

† *Ibid.*

‡ *Dent. Rec.*, January, 1885.



He found it had little or no effect on hard dense teeth, but was more effective on soft white teeth.

Dr. WOODWARD, of New York, gives results of seven or eight cases, thus :—

In one case, slight difference.

In all the rest had no effect.

Dr. HILLISCHER,\* of Vienna, found that a 2 per cent. solution applied on cotton wool obtunds sensitive dentine in one or two minutes.

Dr. RAYMOND,† in many experiments with carefully dried cavities and rubber dam applied, using 10 per cent. aqueous solution to the cavity four times, from three to six minutes each, reports all failures with but a single exception; thirty trials with thirty patients without any apparent diminution of pain.

Trials with citrate of cocaine paste, suggested, I think, by Mr. Brunton, of Leeds.

Dr. MILLER,‡ of Berlin, reports it—

Slow and inconstant action.

In some cases caused considerable pain.

Sometimes no effect whatever.

He says its effects appear to be more superficial upon hard dense teeth than upon soft porous ones.

Mr. SPENCE BATE.§—Ten cases of trial, nearly all young, seven out of ten females :—

\* *B. J. D. S.*, 1885.

† *Cos.*, April, 1885.

‡ *B. D. A.*, August, 1885.

§ *B. D. A.*, April, 1885.

In four cases results markedly successful.

In five cases pain decidedly reduced, but not removed.

In two cases relief was given after two to three minutes.

In others the drug was applied from seven to eight minutes.

“Cocaine dissolved in oil of cloves less satisfactory.”

MR. E. A. CORMACK,\* of Edinburgh (with citrate of Cocaine paste), reports : “used with entire success, only one failure through position and moisture. With rubber dam and mastic plug uniformly successful. Greatest success in teeth of nervous, excitable people, where there is rapidly progressing caries.” *Time given*, 10 or 15 minutes to 25 or 30.

My own experiments with the hydrochlorate in saturated and weaker aqueous solutions were unsatisfactory; no appreciable results were observed after twenty minutes' application. A saturated solution in absolute alcohol answered better in some cases. The latter occasionally gave some pain at first, but reduced sensation appreciably afterwards. Carbolic acid gave better results in some cases tested.

I therefore conclude that as an agent for the reduction of sensibility of dentine, cocaine, in

\* *B. D. A.*, November, 1885.

whatever manner applied, is unreliable in result and inconstant in action; the results obtained being no better than those produced by many other agents used for this purpose. The unvascularity of the tissue possibly explains this.

As an anæsthetic agent to exposed pulps, the testimony borne is again somewhat conflicting.

DR. WOODWARD\* found, after an application of 2 per cent. solution four times in one hour to an exposed pulp, it remained as sensitive as at first.

DR. N. J. HEPBURN† found that after dropping a 4 per cent. solution of hydrochlorate on an exposed pulp, and waiting a few minutes, he was able to remove the pulp without pain being felt by the patient.

DR. IVES‡ reports no success in removing living pulps with 20 per cent. solutions of hydrochlorate.

MR. ARTHUR UNDERWOOD,§ at the Odontological Society, February, 1885, found, after applying a 20 per cent. aqueous solution of hydrochlorate for five minutes to an exposed pulp, it had produced scarcely as much effect as carbolic acid.

DR. G. W. WELD, New York,|| found that an exposed nerve could be partially extirpated with no pain to patient by using solution of cocaine hydrochlorate in menthol (gr. vj. to 3j.).

\* *Cos.*, 1884.

† *Ind. Pract.*, 1885.

‡ *Cos.*, 1884.

§ "Odont. Trans.," 1885.

|| *B. M. J.*, January, 1885.



MR. C. E. TRUMAN,\* in experimenting with cocaine at St. Thomas's Hospital, and using 25 per cent. solution of hydrochlorate in spirit, removed pulp of lower molar for boy æt. eleven, with the engine, and without much pain being complained of, the patient only wincing now and then.

MR. BOYD WALLIS† found, after treating exposed pulp in molar with the paste of cocaine and eugenol twice, with interval of ten minutes, he was able to remove the pulp without any more pain than occurs after arsenious acid.

DR. RAYMOND,‡ after applying 8 per cent. solution to an exposed nerve in upper molar twice, and then injecting 2 minims into the palatine root canal, was enabled to remove pulp entirely with very slight pain. The injection of the pulp by means of a small needle syringe has been suggested, but appears to me an unfeasible operation, since less painful methods of procedure are already in daily practice.

I have found aqueous solutions of hydrochlorate of cocaine, as well as the pure crystals, of no service for reducing the sensibility of exposed pulps, but was enabled to extirpate the pulp of a lateral incisor in a nervous lady with scarcely any pain, after treating it several times with a saturated alcoholic solution of hydrochlorate. I have also

\* St. Thos.'s Hosp. Report, vol. xv.

† *Dent. Record*, 1885.

‡ *Cos.*, 1885.

found the stronger alcoholic solutions of some service when freely exposing pulps before applying arsenious acid.

These results lead me to the conclusion that hydrochlorate of cocaine in low percentages of aqueous solution is powerless to anæsthetize the dental pulps, but with strong alcoholic solution of hydrochlorate, as well as with the pure alkaloid dissolved in eugenol, &c., greater success may be expected.

Before leaving the consideration of topical applications of this drug, I think it proper to mention a few cases, gathered from the medical journals, where certain constitutional symptoms are laid to the charge of cocaine as a local application, some of which, however, might, in my opinion, be referred to other causes.

DR. ZIEM,\* of Dantzic, records the following results of applying 2 minims of a 4 per cent. to the conjunctivæ of a man aged forty. In a few minutes the pupils dilated, face became pale, breathing embarrassed, sweat on forehead, and patient was unable to go home for a quarter of an hour.

Dr. Ziem says 17 cases are recorded in ophthalmic practice in which toxic symptoms occurred; in 14 of these the solution was dropped into the conjunctival sac.

\* *B. M. J.*, November, 1885.

In 8 of these cases 4 per cent. was used.

„ 4 „ „ 2·5 „ „

„ 4 „ „ 2 „ „

And the quantity varied from 2 to 4 minims.

DR. F. DE HAVILLAND HALL, of Westminster Hospital,\* reports an alarming case of laryngeal spasm caused, in his opinion, by cocaine.

A lady æt. fifty-six, who had had a 20 per cent. solution of hydrochlorate of cocaine used with good effect for removal of nasal polypi, had later in the year a 10 per cent. solution syringed into the nostrils, when it produced a condition of spasm of the adductor muscles, such as to threaten asphyxiation, and which necessitated chloroform to relieve it.

DR. HEYMANN,† in a communication to the Berlin Medical Society of brilliant successes with Cocaine, mentions the following as an exception:—

After a liberal application of solution of cocaine (strength not mentioned) to the pharynx and larynx for removal of papillomatous growth, the patient remained in an apathetic and sleepy condition for five hours, with open eyes; he afterwards had considerable difficulty in walking, gait being very uncertain, with general feeling of discomfort; pulse, temperature, and respiration were increased, and the symptoms did not pass off for ten hours.

\* *Lancet*, November, 1885.

† *M. T.*, November, 1885.



It is more especially in its application as a hypodermic injection that cocaine has gained for itself a considerable renown, and greatly extended its sphere of usefulness, the anæsthesia resulting from its employment in this manner in the *soft tissues* being such as to render painless, or at least to mitigate, the suffering of a very large number of minor surgical operations.

The local effects produced by the hypodermic injection of cocaine are more definite and constant than when topically applied. Almost immediately after injection sensibility is deadened around the puncture, and in a few minutes a small circumscribed area of insensibility is produced. This remains for a short time, then gradually passes off, and in about twenty or thirty minutes the part has regained its normal condition.

The hydrochlorate is the salt most commonly used for this method, in solutions varying from 2 per cent. to 20 per cent. or stronger. After several experimental injections into my arm with various strengths, I have come to the conclusion that pretty definite and constant local effects follow the injection of cocaine under the skin. From one to two minutes after injection the skin around the puncture becomes anæsthetized, the anæsthesia increasing in area and completeness for from five to eight minutes, after which there is a gradual return of sensation from the periphery to the point

of injection, reaching the normal in about twenty-five minutes.

The reputation of cocaine as a hypodermic or submucous injection is not, however, a wholly unblemished one, many cases having been reported of grave toxic effects, and still more of unpleasant constitutional symptoms, which have followed its use by this method.

The drug has been used very extensively by surgeons for minor operations, and I think it may be instructive to give the results obtained by a few experimenters as bearing on its use by injection in dental surgery.

DR. COSGRAVE,\* for small tumour of back,  $3\frac{1}{2} \times 2\frac{1}{2}$  inches,  $\frac{1}{2}$  grain in 5 minims of water injected on each side of growth ten minutes before operation; operation lasting fifteen minutes.

*Result*—painless, patient remarking that it seemed strange to see knife cutting and yet feel no pain.

MR. C. RANDOLPH.†—Sebaceous cyst of upper eyelid in little girl æt. twelve. 5 minims of 4 per cent. injected.

*Result*.—No pain at all, wound healed by first intention.

MR. MAYO ROBSON.‡—Epithelioma of tongue removed by galvanic ecraseur. 10 minims of 10

\* *B. M. J.*, January, 1886.

† *B. M. J.*, February, 1886.

‡ *B. M. J.*, February, 1886.

per cent. solution injected deeply into tongue in several places.

*Result.*—Removed painlessly.

My colleague, MR. PEARCE GOULD, of Middlesex Hospital, informs me he has used the drug hypodermically with very good results in the following cases, without the occurrence of constitutional symptoms:—

Two cases of circumcision, adults.

Two cases for ligature of varicose veins.

One removal of small parotid tumour.

Several cases of excision of tonsils.

Radical cure of hæmatocele, &c.

Injecting from 1 to 4 minims of a 20 per cent. solution, and allowing from five to ten minutes to elapse between the injection and operation.

My brother, DR. HERN, of Darlington, tells me he has used the hydrochlorate with very good results in several minor surgical cases in hospital and private practice,—for ganglion, epithelioma of lip, fistula, &c.,—using two injections of  $\frac{1}{8}$  grain each on each side of, or in near proximity to, part to be operated on. No toxic manifestations occurred.

I also find the following *major* operations recorded in which cocaine has been used as the anæsthetizing agent:—

DR. J. MILTON ROBERTS\* performed two grave

\* *B. M. J.*, January, 1886.



operations (one section of head of femur), the cocaine being deeply injected.

*Result* reported as painless.

Successful amputation of thigh after injection of 1 per cent. into skin, and  $\frac{1}{2}$  per cent. into deeper parts. Pain complained of only during sawing of bone.\*

For DENTAL OPERATIONS cocaine has been employed by injection in two different ways: one, a deep injection, the object being to anæsthetise the nerve trunks and produce a central effect; the other, a submucous injection the anæsthetic effect of which is purely peripheral and local.

The results of four cases of *deep* injection by Dr. Raymond are recorded in *Cosmos*, April, 1885.

I. On Dr. Woodbury, for excavation of exceedingly sensitive carious cavity in first right lower molar, 13 minims of 4 per cent. solution were deeply injected close to the right inferior dental foramen, the needle being carried through the internal pterygoid muscle. In three minutes the tongue became thick and numb on right side. In seven minutes almost complete anæsthesia of right half of tongue and gums around inferior teeth. Engine then used to complete excavation without any discomfort. The anæsthesia lasted for twenty-eight minutes. There was some stiffness and sore-

\* *Lancet*, January, 1886.

ness of muscles at dinner on the same day, but no symptoms indicating any unusual treatment were felt the next day.

II. Miss C., æt. seventeen, for whom 10 minims of 4 per cent. solution were injected under the lip close to infra-orbital foramen for excavation of left upper central incisor.

*Results.*—Incomplete anæsthesia of teeth, but complete numbness of lip and side of nose. In twenty-seven minutes sensation returning. In thirty-five minutes normal sensitiveness completely restored, slight soreness of cheek next day, only noticeable when touched.

III. Mr. D., æt. twenty-five, for excavation of crown cavity in right upper wisdom. 13 minims of 4 per cent. solution injected on nerve at its emergence at infra-orbital foramen; parts anæsthetized similar to preceding, but cavity in wisdom remained as sensitive as before injection.

IV. Mr. R., for excavation of cervical cavity in first lower left bicuspid, and a previously tried hyperæsthetic buccal cavity in molar. 5 minims of 10 per cent. solution were injected at inferior dental foramen.

*Results.*—In three minutes tongue anæsthetized; in ten minutes cavities excavated without any pain further than the consciousness of the instrument's presence. No pain with cold water, but con-

siderable pain felt soon after when stopping the cavities.

Some patients complained of after pain in the region of the syringe puncture.

DR. PERRY'S individual experience:—On following day, after injection of 2 minims close to mental foramen, felt uncomfortable sensation on that side of face, which soon increased to sudden jumps and starts, and pricking sensations. On second day after, uncomfortable feeling much lessened. On third day after, original sensations returned, which were worse at end of day when tired. On the fourth day after, same sensations present, only more pronounced. The further history of the case is not reported.

DR. HEPBURN.\*—8 minims of 4 per cent. solution injected in close proximity to the inferior dental foramen, resulting in anæsthesia of lower lip, molar, canine, and incisor teeth, and partial anæsthesia of tongue on that side. Anæsthesia lasted half-an-hour.

In the absence of any experience of this method of injection, it appears to me, apart from the possibility of being followed by unpleasant local symptoms, such as those experienced by Dr. Perry, to be open to grave objections from the danger of wounding important structures, and to be a remedy so disproportionate in its risks to the objects of

\* *Ind. Pract.*, January, 1885.



relief, that I for one should hesitate to employ it for such operations.

As a *submucous* injection for the purpose of extraction, very many dental surgeons have recorded experiments, a *résumé* of which I now give, in some of which the results obtained, both as regards immunity from pain as well as from constitutional symptoms, are so enviously satisfactory that one can only congratulate the experimenters.

DR. W. BARKER\* says in the majority of cases of extraction insensibility to pain may be produced by submucous injections of 5 minims of 4 per cent. solution.

*Results.*—In five to eight minutes the full anæsthesia is produced, the extent of insensibility being limited to a small space around the place of injection. The effect lasts from ten to fifteen minutes, then passes away. Never had any sign of local inflammation, swelling, or systemic disturbance.

MR. HUNT,† of Yeovil, suggested the use of warm solutions of 1 grain in 9 minims of water.

*Results* in first dozen cases.—“Some patients, *no pain* at all complained of; in all the rest the pain was all but done away with, and they were without exception most gratified.”

No constitutional symptoms or local irritation observed.

\* *Med. Pract.*, June, 1885.

† *B. D. A.*, January, 1886.

PROFESSOR REDARD\* records about forty cases of injection of hydrochlorate performed at Geneva Dental School. He injected 50 to 75 centigrams of 15 per cent. solution.

*Results.*—In all cases, the extraction, which was usually performed by him in ten minutes after injection, was *absolutely without pain*. No unpleasant accessory effects were observed, except some nausea and heaviness of head in young girls and children.

MR. W. J. MARSON† reports most satisfactory results in about 100 cases of extraction; 10 minims of 10 per cent. solution employed, and 5 minims were injected on each side of alveolus. He mentions frequent complaints with patients of having passed a restless night after the operations, and in two cases nausea was noted.

MR. TRUMAN‡ reports his results of trial with cocaine in sixteen cases of extraction, in only two or three of which pain was complained of.

In two cases of injection of 1 grain, there was faintness and pallor, with cold perspirations and feeble, hardly perceptible pulse.

In another case, where  $1\frac{1}{2}$  grains were injected, the patient felt sick and faint, and seemed bewildered.

\* *B. M. J.*, February, 1886.

† *B. M. J.*, February, 1886.

‡ *St. Thos.'s Hosp. Reports*, vol. xv.

M. GEORGE VIAU\* records eighty-six cases of use of cocaine with a 2 per cent. solution of carbolic acid. Out of these, thirty were males, and fifty-six females. He employed 5 centigrams ( $\frac{5}{6}$  of a grain) of cocaine. Time between injection and operation, from five to six minutes.

*Results.*—Neither sex nor age influence the anæsthesia produced. No pain. Never met with constitutional symptoms.

M. TELLSCROW, in introducing Witzel's method of using cocaine to the Clinic of Dental School of Paris, used 10 centigrams ( $1\frac{2}{3}$  grains). He operated on eight patients with uniform success; in every case anæsthesia complete or sufficient.

In two of these patients there were exhibited constitutional disturbances of an alarming nature, and some others felt general malaise of a less marked character, but sufficiently severe to render caution necessary.

MR. CUMMING† records a case of a patient, a lady æt. twenty-five, for whom he injected 7 or 8 grains of cocaine in as many days for the extraction of roots, with fairly good results as to pain, and in whom no constitutional effects followed.

He also records his individual experience of 1 grain injected for extraction of upper central incisors. Immediately after injection the lips

\* *B. D. A.*, March and April, 1887.      † *B. D. A.*, February, 1887.



swelled up, and tongue had a sensation as if scalded. In two minutes teeth were extracted, each with considerable pain. It produced irregularity of the heart, tingling, and cold extremities, which lasted two hours. For two days the patient was almost prostrate, and without sleep.

MR. J. M. ACKLAND has related to me a case of a female, æt. fifty, for whom he injected 10 minims of 10 per cent. solution for the extraction of an upper wisdom tooth, and immediately afterwards, for experimental purposes, repeated the dose for the removal of an upper central incisor. Both operations were performed painlessly, but an attack of vomiting supervened, accompanied by some incoordination of movement. The symptoms passed off in a short time.

MR. CHAS. TOMES\* reports his personal experience of 1 grain injected in neighbourhood of a painful tooth, which failed to abolish the sensibility, and shortly after injection unpleasant toxic symptoms supervened, among which were giddiness, nausea, slight unsteadiness of gait, cold and clammy hands. The sensations of nausea and feelings of discomfort persisted for two or three hours.

MR. BALKWILL,† of Plymouth, also relates his personal experience of  $1\frac{1}{2}$  grains injected for re-

\* "Trans. of Odonto. Soc.," 1886.      † *B. D. A.*, November, 1887.

moval of second lower right molar. Four minutes from first injection the tooth was extracted by himself at second attempt.

*Results.*—Anæsthesia was complete in the gum, but there followed in one minute peculiar sensations all over the body, not exactly of nausea or faintness, but more like that produced by exhaustion, cold, or want of food, also decided dimness of sight, and sense of depression at pit of stomach.

In two minutes there was free perspiration over the face without pallor, decided numbness of right cheek and lips beyond angle of mouth, and as high as the cheek-bone. Also inability to hold back the lips when extracting the tooth.

In ten minutes pulse became very slow and feeble, necessitating 3j. of Sp. Ammon. Aromat.

In fifteen minutes noticeable diminution of numbness of cheek and lips.

In two hours numbness and general uneasy sensations nearly disappeared.

MR. TOTHILL\* records six cases of injection:—

In first case, a girl æt. twelve, injection of 1 grain in warm water, and extraction, performed after six minutes, was followed by stupor and vomiting.

In second and third cases, robust young women, with the same dose and time. It was followed in each case by slight pain and stupor.

\* *B. D. A.*, April, 1887.

In the fourth case, an anæmic girl, with an injection of 1 grain, and the tooth extracted after ten minutes. The patient lost consciousness for two-and-a-half hours.

In the fifth case, an old man, with same dose, &c. No pain was felt, and no constitutional results.

In the last case, a gentleman æt. twenty-seven, injection of  $\frac{1}{2}$  grain. This was followed by violent struggling, dilated pupils, and vomiting.

DR. HEPBURN\* finds that the use of 20 to 30 minims of 4 per cent. solution ( $1\frac{1}{6}$  grains) is often followed by constitutional effects, which, while not dangerous, are somewhat disagreeable to the patient. They are as follows:—Some general anæsthesia, staggering gait, double vision, dilated pupils, dizziness and nausea; which effects usually pass off in an hour or so.

DR. SCHILLING reports in *Lancet*, January, 1886, *ex. Pharmaceutical Journal*, 6 minims of 20 per cent. solution, injected for extraction of upper molar, was followed by symptoms of which unconsciousness and rigid aspect of the face were the chief. Inhalation of three drops of amyl nitrite restored the patient to consciousness.

DR. ELDER, of Nottingham,† reports:—12 minims of 10 per cent. solution (freshly prepared), injected

\* *Ind. Pract.*, January, 1885.

† *Lancet*, November, 1886.



under skin for opening superficial abscess, followed in three to four minutes by syncope, twitching of face, falling of jaw, coldness of body, clammy perspiration, lividity of face, and, in fact, all the appearances of imminent death. The patient was several minutes recovering consciousness, and during the remainder of the day felt very prostrate.

DR. KNAPP\* records headache, vertigo, nausea, tottering gait, pallor of skin, cold sweat, &c., as resulting from daily injection of 24 minims of the 4 per cent. solution of hydrochlorate.

The results of my own experience with cocaine for extractions, culled from trial of ninety cases for which I have used it during the past two months at the Middlesex Hospital and the Dental Hospital of London, in the carrying out of which I have great pleasure in acknowledging the valuable and intelligent assistance of Mr. Rouw, the House Surgeon, as well as the Assistant House Surgeons, are as follows (the hydrochlorate was used in fresh 10 per cent. solutions):—

Of the patients 58 were females, 32 males.

	Males.	Females.	Total.
Under 15 there were .. ..	10	9	19
Over 15 and under 20 .. ..	8	20	28
Over 20 and under 30 .. ..	6	18	24
Over 30 and under 50 .. ..	8	11	19
	32	58	90

Average amount injected was 7 minims.

\* *Lancet*, November, 1885.

*Amount Injected.*

In 2 cases 3 minims were injected.

„ 9	„ 4	„	„
„ 32	„ 5	„	„
„ 30	„ 6	„	„
„ 6	„ 7	„	„
„ 3	„ 8	„	„
„ 7	„ 10	„	„
„ 1	„ 12	„	„

*Results as to Pain.*

	Males.	Females.	Total.
1st. Where markedly successful, no pain being complained of ..	15	28	43
2nd. Where pain was reduced but not entirely removed .. ..	14	26	40
3rd. Considerable pain, not relieved at all .. .. .	3	4	7

The average time between injection and operation was 7 minutes (nearly).

In 1 case it was 3 minutes.

„ 4 cases it was 4	„
„ 15	„ 5
„ 17	„ 6
„ 27	„ 7
„ 15	„ 8
„ 6	„ 9
„ 4	„ 10
„ 1	„ 11

The operations performed were as follows:—

*Extractions.*

Molars	...	...	...	...	56
Bicuspid	...	...	...	...	25
Canines and incisors			...	...	13

In six cases double extractions were performed, the teeth removed not being in proximity to each other. In these cocaine was injected for one tooth only, and in order to leave the patients free from prejudice and bias in their reports of subjective sensations, the tooth to be removed without cocaine was injected with water in two instances. Nearly all patients agreed in reporting more pain where cocaine was not used, and, I may add, their demonstrations coincided with their statements. In one case only the patient stated "there was not *much* difference."

*Pulse.*—It is difficult to estimate the effect on the pulse, especially in hospital patients, inasmuch as the results of mental excitement, due to the impending operation and the effects of the sights and sounds of the operating rooms, cannot be eliminated. The usual effect noticed was a considerable increase in the rate of the pulse. In twenty-five cases where the pulse was taken before injection, and again two to three minutes after, the average increase in the rate of the pulse was 15.

In twenty of these cases the pulse was taken again from ten to twenty minutes after the injection and operation. In fifteen of these the pulsations



averaged 14 above the rate before injection; in the remaining five the average pulsation was 6 below the rate before injection.

*Constitutional Effects.*—In three cases somewhat distressing toxic symptoms were produced, as headache, severe palpitation, syncope (not severe), nausea, precordial pain, tingling, unsteadiness of gait, vertigo, cold perspiration, and some prostration. These passed off in two cases, in one of which coffee was administered with good effect, in about half-an-hour; in the third case, a girl æt. eighteen, who manifested a good deal of hysteria, only after an ice-bag had been applied to the head, and the patient had slept about an hour.

In one of these cases 10 minims of the 10 per cent. solution was given; in another, 8; in the third, 6. The patient to whom 10 minims was given was injected on the following week with half the previous dose (viz., 5 minims), and with the exception of very slight palpitation had no bad symptom.

In fifteen cases slight constitutional symptoms were observed, such as pallor, feeling of faintness, slight giddiness, hot or cold perspirations, all of which passed off in a few minutes. In some of these the symptoms were only objective—*e.g.*, pallor and slight perspiration over the face—in which the patients declared they *felt* nothing amiss.

I am unable to lay these symptoms wholly to

the charge of the cocaine, inasmuch as the mental effect of apprehension, coupled with the slight physical pain of the syringe puncture, might have produced them; we see such symptoms sometimes follow the operation of vaccination in adults.

For injection a *small* needle was used.

### *No. of Punctures.*

In 4 cases 1 puncture was made.

„ 51	„	2 punctures	(1 outside, 1 inside alveolus).
„ 23	„	3 „	(2 „ 1 „).
„ 12	„	4 „	(2 or 3 outside, 1 or 2 inside alveolus).

The three punctures seemed to give the best result—one on the lingual aspect of the tooth, and two on the labial; the latter being placed, one in front, and the other behind the prominent ridge on the buccal alveolus corresponding to the root of the tooth operated upon.

The pain due to the puncture for injection may be reduced considerably by using, first, small needles; secondly, by injecting one minim of cocaine immediately the point is introduced to the mucous membrane, after which the further intrusion of the needle is not felt by the patient.

Before proceeding to a conclusion I would like to point out that—

- 1st. We are dealing with a powerful alkaloid, as demonstrated by its physiological action.

2ndly. We are using it in a manner by which its full physiological effect on the system is very rapidly attained, and by which errata are easily and surreptitiously introduced.

Bearing these in mind three guiding principles can, I think, be formulated—

- I. That the dose should be a very reduced one.
- II. The instruments used should be scrupulously clean.
- III. The solutions should be perfectly pure.

The necessity of the first may be gathered from the analogous therapeutical employment of other alkaloids.

The importance of the second is known to all, and the significance of the third is better appreciated from the fact that aqueous solutions of cocaine and its salts are found after the lapse of a few days to develop a fungus which usually produces a cloudiness of the solution. And many cases are reported in the medical journals of untoward results following the use of stale solutions of cocaine; fresh solutions should, therefore, only be used.

The foregoing cases, I think, show that—

- I. Doses of 1 grain and upwards, hypodermically injected, are comparatively frequently followed by constitutional



symptoms, which, if not actually grave, are nevertheless distressing and disagreeable.

II. That doses of which the maximum is half a grain, though not absolutely free from constitutional effects, are very much less frequently followed by such. The symptoms, if any, produced, being for the most part transient and unimportant, the unpleasantness commonly passing off in a few minutes.

III. The anæsthetic results of half-grain doses for the extraction of teeth lead one to think that any further serious reduction in amount would be insufficient to relieve the pain of the operation.

In judging of the practicability of the employment of cocaine as an anæsthetic for extractions, one has to weigh the advantages and disadvantages of its employment, and compare it with those agents for the production of general anæsthesia now in use. After doing so, I am led to the following conclusion, viz., that as an agent for general use in extraction :—

I. The physical barrier to injection which the bony alveolus interposes.

II. The pain, however slight, due to the puncture of the syringe.

- III. The mental suspense due to the necessity of waiting several minutes between the injection and operation.
- IV. The full consciousness under which the operation is performed.
- V. The varying idiosyncrasy of patients with reference to the drug.
- VI. The inconstancy of production of complete anæsthesia.
- VII. The necessity of limiting the dose, so that only one part of the mouth can be safely anæsthetized for the same patient at a given time, and that only such as to allow of one, or at most two teeth being removed.

These all combine to relegate the drug to a subordinate and secondary position, leaving nitrous oxide gas in the possession of the field, as the *facile princeps* for the vast majority of such operations. Other than for extraction there are various operations in which cocaine can be beneficially employed as an obtunding agent, as a submucous injection in dental practice, such as for wedges, clamps, separators as recommended by Mr. Smale, the excision of gum tissue, removal of small growths, opening of deep-seated abscesses, reduction of pain in manipulation of fractured maxilla for models or splints, operations on teeth affected with acute periostitis, &c., and in doses not exceeding  $\frac{1}{2}$  grain

of the hydrochlorate may be performed in a painless manner, and without serious risk of toxic symptoms.

In judging of the results of all local anæsthetics, the effect of imagination on the mind of the patient has to be eliminated. With due regard to this, I believe that cocaine, although not all that could be wished, is yet one of the most powerful local anæsthetics which have been introduced to the profession of late years, and is on the whole a valuable and material addition to the Dental Pharmacopœia.

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## DISCUSSION.

MR. J. S. TURNER said the amount of matter submitted for their consideration that evening was so large, that it would be impossible to enter upon a profitable discussion unless some opportunity was afforded for its digestion and assimilation. He thought it likely that arrangements might already have been made for the business of the next meeting which would prevent the possibility of the proper discussion of this interesting and important subject then, and in that case he would suggest that it should be adjourned till November, by which time the members would have ample opportunities of enlarging their experience.

MR. HENRI WEISS suggested that, if it was not contrary to rule, the discussion on these papers might be taken at the next meeting in place of the usual Casual Communications.

The PRESIDENT said that at that time there were not many Casual Communications entered for the June meeting, but he doubted whether the half-hour set apart for this part of the business would suffice for the discussion of a subject in which so much interest was taken. The paper at the next meeting would be read by Professor Horsley, and the time for that must not be encroached upon.

MR. S. J. HUTCHINSON supported the proposal to adjourn the discussion till November. Much additional information might be gained during the interval if members would keep careful records of the results of injection cases, and especially of those in which unpleasant effects occurred. He thought the delay would bring about a more instructive discussion.

MR. STORER BENNETT suggested that the discussion should be made the special business of the evening, no paper being read at that meeting. A very general interest was taken in the subject, and a good many of the members would probably wish to relate their experiences.

MR. HERN asked whether an extra meeting could not be arranged in June, at which the adjourned discussion could be taken?

MR. STOCKEN spoke in favour of the adjournment till November, and formally moved a resolution to this effect, which was seconded by Mr. Charters White, and carried by a considerable majority.

The PRESIDENT then thanked Messrs. Cunningham and Hern on behalf of the Society for their very interesting and valuable papers; also Dr. Elliott and Messrs. Humphreys, Lloyd Williams, and Wallis for their Casual Communications, and announced that at the next meeting of the Society (on June 7th) a paper would be read by Professor Victor Horsley on a case of Epileptiform Neuralgia of the Fifth Nerve.

The Society then adjourned.

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#### DESCRIPTION OF PLATE.

Lower jaw of a gorilla, purchased by the Society, with the skull, in 1885, having two supernumerary teeth embedded in the bone beneath the coronoid process and sigmoid notch. Originally only a small nodule of enamel was visible on the inner surface of the right ascending ramus, just external to the upper extremity of the inferior dental canal. On cutting away the bone, this nodule was found to be a portion of a supernumerary tooth having a conical crown and a single tapering root. Lying above it another supernumerary tooth was discovered, of which there had previously been no sign whatever. This was likewise exposed by removing the superjacent bone, and found to be a larger tooth with a conical crown and three long narrow roots. The teeth were lying parallel to each other, with their crowns pointing upwards and backwards, so that they could hardly under any circumstances have been erupted in the alveolar arch.



## EXPLANATION OF PLATES TO DR. BUXTON'S PAPER.

(See page 90.)

These plates represent curves taken in the Physiological Laboratory of University College, London, by kind permission of Professor Schäfer.

No. I shows the pressure of blood in the carotid. As soon as the nitrous oxide gas had fairly replaced the air in the lungs a slight fall of blood pressure took place, which continued until the nitrous oxide was turned off and the animal was permitted to breath air, when a rapid rise of pressure took place.

The lower curve represents the changes of volume occurring in the kidney of an animal under nitrous oxide. The kidney was enclosed in an oncometer and the curve taken with an oil manometer. In this case a decrease in the size of the kidney appeared at the same point as that at which the blood pressure began to fall. This change in the kidney represents a fall of blood pressure in that viscus. Upon access to air complete resumption of normal pressure took place.

In No. II similar curves are taken when the artificial respiration performed mechanically upon a curarised animal was discontinued. In marked contrast to No. I, the kidney curve did not fall, while the blood pressure curve underwent little change. Hence, comparing a brief period of deprivation of air with a similar period during which nitrous oxide is given, both the blood pressure and the kidney curves differ.

No. III shows the effect of a very prolonged period of nitrous oxide administration.

No. IV shows the effect of deprivation of air for a like period. In the first case the blood pressure remains unaltered or falling slightly, but eventually falls rapidly, and

## EXPLANATION OF PLATES.

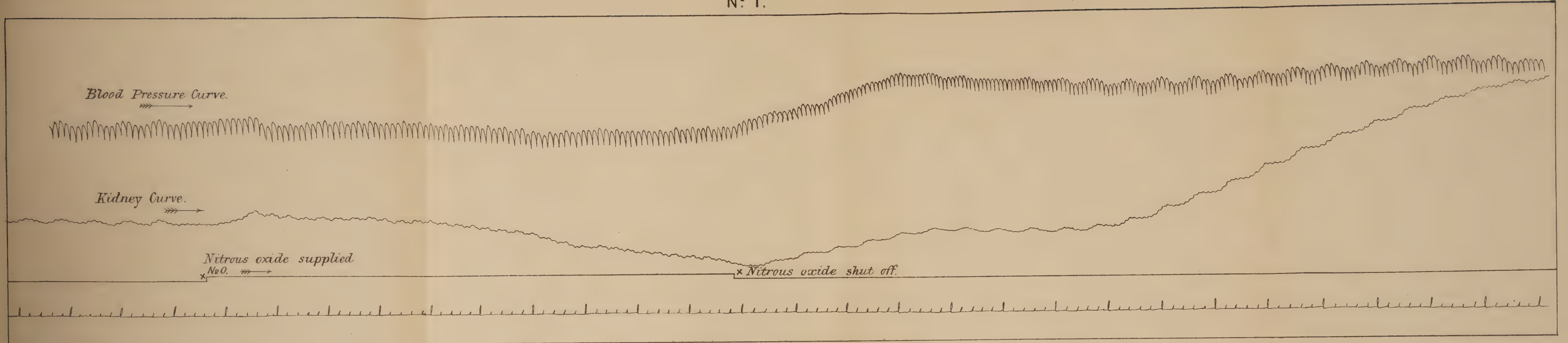
finally recovers by passing through a period of vascular excitement marked by leaps and bounds. Under asphyxial conditions the blood pressure curve is raised almost from the beginning.

Under nitrous oxide (III) the kidney, as soon as the gas has fairly asserted itself, steadily contracts until, simultaneously with the fall of blood pressure, it undergoes a very marked and rapid diminution in size. Under asphyxia (IV) the kidney does not contract until the heart has given out, as shown by the tumultuous state of the blood pressure curve; then the kidney rapidly contracts. Thus in III the contraction is more gradual and occurs much sooner than in IV, and is wholly independent of heart failure, as in III the heart was beating regularly and well throughout the time occupied in taking the trace.

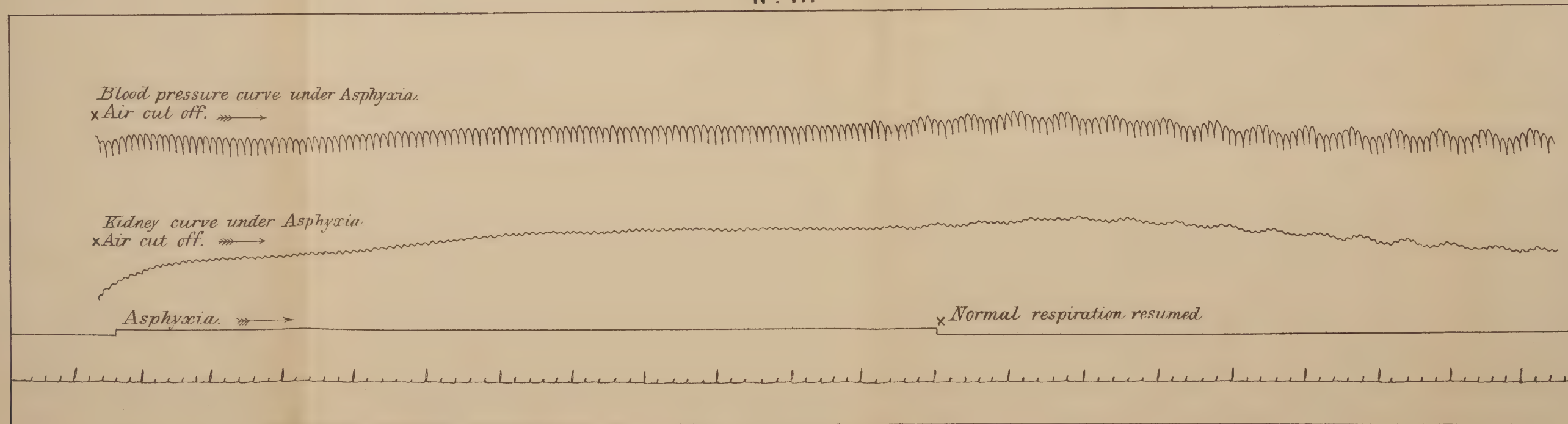
No. V shows further blood pressure and kidney curves under nitrous oxide.

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Nº I.



Nº II.





THE END OF THE WORLD



Nº III.

20 SECS

Blood pressure curve.

Kidney curve.

Nitrous oxide.

x Cut off.

Nº IV.

Blood pressure curve.

Kidney curve.

Air supply closed.  
Asphyxia

Air supplied.





Nº V.

A1.

Blood Pressure Curve



Kidney Curve »»→

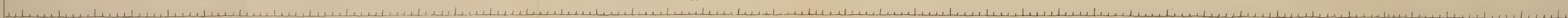


Nitrous oxide turned on

x N<sub>2</sub> O. »»→

Nitrous oxide shut off

x





# Odontological Society of Great Britain.

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## ORDINARY MONTHLY MEETING.

*June 6th, 1887.*

CHAS. S. TOMES, F.R.S., PRESIDENT, IN THE CHAIR.

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THE Minutes of the previous meeting having been read and confirmed,

MR. W. B. PATERSON signed the Obligation Book, and was formally admitted to membership by the President.

DR. DUDLEY BUXTON and MR. J. BLAND SUTTON, F.R.C.S., were then balloted for and elected Honorary Members of the Society, and MR. J. TRUDE FRIPP, L.D.S. Ed. & I., of Willesden, was also elected a Resident Member.

The Librarian (MR. WEISS) called attention to a copy of Crowley's Dental Bibliography, on the margin of which were marked the case numbers of those books which were to be found in the Society's Library, thus showing at a glance those which it did and those which it did not possess. Hitherto, in order to be sure that a book was not in the Library, it had been necessary to search first the Catalogue and then the Appendix. This little book would therefore, he thought, save a good deal of trouble.

The Curator (MR. STORER BENNETT) said he had received several additions to the Museum since the last meeting. Mr. A. B. Alexander had sent some models of cleft palate cases, and Mr. Rogers, of Cheltenham, a fine disarticulated skeleton of a badger. He had also received a number of fossil teeth of sharks, elephants, deer, &c., from Mr. R. J. Larking. A



large portion had been found between Charleston (U.S.A.) and the Bull River; the rest had been discovered near Mons, in Belgium. He had hoped that Mr. Larking would be able to write a paper on the subject for the Society, but he was about to sail for Australia, so had merely handed over the collection, which was a very fine one, for the Society's acceptance.

MR. HENRI WEISS showed the crown of a right lower first bicuspid, the loss of which had been consequent on inflammation spreading from an alveolar abscess attached to the first deciduous molar, the formative tooth pulp having been destroyed, and the cap of the growing tooth exfoliated.

The history of the case was briefly as follows:—The patient, a little girl, four years of age, was brought to him at the National Dental Hospital with a history of several attacks of swelled face. On examination there was seen on the surface of the gum what at first sight looked like a piece of bone—a portion of the alveolar process, or a portion of the root of the first temporary molar. But on closer examination it proved to be the crown of the first bicuspid, lying in a crypt on the gum and barely attached. Feeling assured that it was necrosed and quite useless, Mr. Weiss removed it and left the carious deciduous tooth in the hope that it might still render some service in the process of mastication.

Whether or no any trace of tooth pulp had been left which would continue to build up a deformed kind of tooth, must be left as a matter of speculation.

The point for consideration in a case of that kind was, what action should be taken when an alveolar abscess occurs at a period coincident with the active development of the crowns of the permanent teeth? The great advantage of retaining the temporary teeth until their successors were ready to take their place was known to all. It only remained to determine whether any period could be laid down within which it would be justifiable to extract any given temporary tooth, so as to preclude as far as possible any interference with the perfect development of its successor.

MR. ACKERY remarked that cases like that which Mr. Henri Weiss had mentioned were by no means uncommon. He had quite recently had a child brought to him with the roots of a first temporary molar and the necrosed crown of the corresponding bicuspid both lying on the surface of the gum; he removed them together.

MR. STORER BENNETT showed a curious specimen of abnormal tooth development in a jaw of the Stone Age, one of those which had been exhibited to the Society some months previously by Mr. Cunningham. It was the lower jaw of a child, on careful examination of which he found one of the second bicuspid, partially formed, in an inverted position, with its cusps downwards and its root upwards between those of the second temporary molar.

The PRESIDENT remarked that the specimen was specially interesting as showing that dental irregularities were not things of to-day.

MR. WILLOUGHBY WEISS showed, for Mr. J. B. Bridgman, of Norwich, models of a case of irregularity in a girl, aged eighteen, one of the worst he had ever met with. The peculiarity of the case was that the upper centrals were almost directly in front of the laterals, and also outside the arch. Mr. Bridgman was anxious to obtain the opinion of members as to the mode of treatment most likely to effect a speedy improvement, the patient being in humble circumstances. The prevailing opinion seemed to be that the centrals should be extracted.

MR. BOYD WALLIS showed a very handy little instrument for removing cotton dressings, designed by Mr. Butler Smythe, of Brook Street.

MR. S. J. HUTCHINSON exhibited the Welsbach Incandescent Light, consisting of a small Bunsen burner over which is placed a cap made of cotton impregnated with some mineral salts. It gave a very brilliant white light with very little heat.

The PRESIDENT then called upon Prof. Victor Horsley, F.R.S., to read the paper of the evening on "The Pathology of Inveterate Neuralgia of the Fifth Nerve."

*Notes on the Pathology of Inveterate Neuralgia of the Fifth Nerve, illustrated by cases treated successfully by Avulsion of the Nerve close to the Skull.*

BY VICTOR A. H. HORSLEY, M.B. & B.S. LOND., F.R.C.S., F.R.S.,  
Assistant Surgeon to University College Hospital,  
Surgeon to the National Hospital for the Paralysed  
and Epileptic, &c.

MR. PRESIDENT AND GENTLEMEN,

It is not, of course, my intention to weary you with details of cases of neuralgia which I have treated by operation, but I wish to bring before you certain points of interest in these cases, and more especially points in regard to diagnosis; points, moreover, upon which I am very desirous of obtaining information. For these cases have only come under my observation at a very late stage of the malady. The earliest period at which a patient has applied to me has been three-and-a-half years after the onset of the mischief, whilst in one case it was as much as seven years after.

In all the cases, after operation, I have heard the same story, viz., gratification at being relieved from pain, and regret at the loss of many sound and useful teeth. Are there then no indications by which we can diagnose pain which is due to



mischief somewhere along the tract of the nerve from that which is due to disease of the teeth? If we could do this with some degree of certainty we should make an important step forward in dealing with these painful and often troublesome cases, and it is in the hope of being able to decide this question that I desire to have to-night the benefit of the experience of the Odontological Society.

Now if a patient comes to us complaining of pain in the area supplied by the fifth nerve I take it that we at once put the question to ourselves whether the pain is caused by mischief of cerebral origin, or whether it is due to peripheral irritation; and if the latter, whether the disease is somewhere along the trunk of the nerve or in the teeth.

It is scarcely necessary for me to dwell on the possibility of the pain being due to intra-cranial disease. The general rules for the detection of intra-cranial mischief will generally suffice for its discovery. The next question, viz., the diagnosis between affections of the trunk of the nerve and of its peripheral terminations, is, however, not so easy.

Perhaps if I mention to you the main points in the cases which I have treated,—two of the patients are in the next room,—these will serve as centres on which the discussion may turn.

The first case is that of a man, aged sixty, who had suffered for seven years before I saw him. All the branches of the fifth nerve were affected,

but it was clear that the starting point of the attacks was the middle division of the nerve. The pain appeared to arise about the centre of the malar bone, and from that point it radiated over all the branches of the fifth on the left side of the face.

Thinking that the source of irritation was in the superior maxillary division, I cut down upon the infra-orbital branch, and following it up, removed as I believed the whole of the nerve as far back as the foramen rotundum. The pain was entirely relieved for the time, but returned in a few days in the palate. Thinking that the posterior palatine branch might have escaped me, I cut down upon the palate and removed the palatine nerve.

After this operation the pain ceased for seven months, when it recurred in the inferior dental nerve, and I was obliged to operate again and remove a considerable portion of this nerve. I believe I am justified in saying that experience shows that it is not sufficient to destroy the inferior dental nerve as it lies in its bony canal; it must be removed close up to the foramen ovale.

You can reach the nerve perfectly well, without injuring any important structure, and without producing any appreciable scar,—provided, of course, that primary union is obtained,—by adopting the following method.

The part being shaved, &c., a superficial incision is made, with strict antiseptic precautions, just in

front of the ear, and extending from the zygoma to the angle of the jaw. From this point a further cut is made, along and below the edge of the jaw, as far as the facial artery. The triangular flap of skin thus mapped out is reflected forwards, great care being taken to raise with the skin only the superficial fat, *i.e.*, not quite to the deep fascia. The reason of this is that the branches of the facial nerve as they issue from the anterior border of the parotid gland course over the deep fascia covering the masseter muscle. The edge of the parotid gland must now be defined at the upper part, where Stenson's duct leaves it, and here it must be detached upwards and backwards from the masseter muscle. This can be accomplished with perfect safety to the surrounding structures, *e.g.*, the duct and facial nerve, by making a horizontal incision through the masseteric fascia from the posterior to near the anterior border of the muscle and then raising the tissues from off the muscle.

This done and all the parts held aside, the masseter is divided on the jaw and pushed upwards, together with the superficial parts, and downwards and backwards with retractors. The jaw is now trephined just in front of the strong ridge which runs down the outer surface of the ramus from the condyle. The outer plate of bone removed, the nerve is found in its canal at its upper end. The nerve and artery being pushed backwards, the



ramus of the jaw is further divided upwards by bone forceps until the trephine hole is laid into the hollow of the sigmoid notch. The inferior dental nerve can now be followed up by pressing aside the fat and vessels to within half an inch of the foramen ovale. Here it is divided, and about an inch of it removed. The parts are then approximated, a catgut drain placed in the cavity and brought out opposite the middle of the incision, the skin carefully united by means of horsehair sutures, and the wound covered with a dry dressing of boracic acid, carbolic gauze, and a little sal alembroth\* wool. Healing, so far, has invariably taken place *per primam intentionem*.

I performed this operation about seventeen months ago, and the patient tells me that he had complete relief until within the last week, when he had a few twinges in the palate, but none in the part supplied by the inferior dental. Whether or no this is going to be the commencement of a recurrence of the original mischief in the middle division I cannot say, but, at all events, the patient has had more than a year of complete relief.†

The next patient was a man, aged sixty-five, for whom I performed the operation of removing the

\* *Sal alembroth*, a double salt of perchloride of mercury and ammonia; wool soaked in a solution of this is used by surgeons as an antiseptic dressing.—ED.

† September, 1887. These twinges disappeared after a few large doses of gelsemium.

middle division of the fifth nerve only. This was followed by complete relief, and he remains cured so far. The operation was performed about nine months ago.

The third case is that of the matron of an infirmary, who had suffered severely for three-and-a-half years. Many drugs had been tried, and the only one which for some time seemed to control the pain was croton-chloral. I performed the same operation on her as on the preceding patient, and she also has obtained entire relief.

The last case, operated on only a few weeks ago, and which I treated in conjunction with Dr. Blok, of Stoke Newington, was the worst I have ever seen. The patient, a lady, had not for a fortnight previous to the operation been able to take food by the mouth at all. The lower lip was much swollen, and the slightest contact with anything caused intense pain, which was most acute in the inferior maxillary nerve, but radiated to the other branches of the fifth. It was so distinctly localized in the inferior dental nerve that this was obviously the one to remove. I therefore performed the operation just described. A slight salivary fistula resulted, but this did not interfere with the healing of the wound by the first intention, and the fistula rapidly closed on the application of caustic by Dr. Blok. The patient has been quite free from pain since.

These, then, are briefly the details of the cases upon which I now propose to dwell for a few minutes, and I think it will be better, for the purpose of fixing the points of the problem before us, if we consider for a moment the anatomy of a mixed sensory nerve, and thus place the question on a broad basis.

In the first place we must admit that, whatever may be the ultimate physiological explanation of the fact, there must be in a mixed nerve fibres which exert a trophic influence on the parts supplied by the nerve, and if these are damaged, degenerative and inflammatory mischief will occur.

Next we have fibres of common sensation coming from the skin.

Thirdly, we have vasal fibres going to the vessels.

And, lastly, we have fibres of special sensation ; in this case, of course, coming from the teeth.

Then all nerves, so far as we know, are themselves provided with fibres of common sensation, that is to say, fibres which terminate in end-organs in the sheath of the trunk of the nerve, and which give it common sensation. This fact is a comparatively novel one ; it was foreshadowed by Mr. J. Marshall in his Bradshaw Lecture for 1884, and anatomically demonstrated by myself in 1885.\*

Now the problem for us to-night is, can we

\* Medico-Chirurgical Society's Proceedings.



diagnose between irritation affecting the trunk of the nerve, and that affecting its terminations? This is the point upon which I ask your assistance, for, as I said just now, I have no experience of the initial stages of the trouble, the time at which it is most important that a correct diagnosis should be made; and conclusions based upon the symptoms of the later periods of the disease may not be altogether reliable when applied to explain those of earlier stages. But, speaking from the point of view of cases as I have seen them myself, it has occurred to me that there are some points that may help us to attempt a diagnosis of this sort.

If the mischief affects the termination of the nerve, it will be clear that there can be no changes in parts which are supplied by other branches of the nerve, except through reflex action. For instance, we should not expect to get wasting of one side of the face as the result of neuralgia commencing in the teeth, or if this did occur it would be very slight. But if, on the other hand, the mischief should be somewhere in the trunk of the nerve, one would expect these trophic changes to occur. And I believe that this is the case. In short, that pain which is of reflex origin is not accompanied by obvious changes in the parts to which the pain is referred, whereas pain which is due to disease of the trunk of the nerve usually is.

Now what are these changes? I have spoken of wasting, but there are various other pathological conditions which may be met with. The patient whom I last operated on presented some of these in a very marked degree. The lower lip was greatly swollen and very sensitive, the skin being glazed and shiny. The same thing was noticed by Mr. Walsham in his report of two cases of this kind. The condition is, of course, primarily, a vascular one, and instead of this state of chronic congestion, the vessels may be at one time dilated, and at another in just the opposite condition. So much for the trophic and vaso-motor fibres.

Next as to common sensation. It is of course true that in an ordinary case of toothache the pain may radiate, not only from the part affected, but may affect all the branches of the fifth nerve, thus producing hyperæsthesia reflexly. Now if the disease is in the trunk of the nerve you may find the skin hyperæsthetic at one place and anæsthetic at another. Is this condition of real objective anæsthesia known to you as occurring reflexly from dental irritation?

There is another very important variety of hyperæsthesia, which, so far as I am aware, is only met with when the disease is in the trunk of the nerve, viz., when gently touching the skin causes extreme pain, whilst if you press firmly it causes no pain at all. This is a very striking form of

hyperæsthesia, and one that is well known, but has never been explained.

I say nothing here with regard to the pain, the whole malady in the patient's view of the case, as I shall speak specially of it directly.

As the result of disease of the teeth we may have hyperæsthesia in varying degrees, and in this connection I would ask for information whether in those cases in which the pain is distinctly removed by extraction of a tooth and then observed to recur in the next, whether there is any difference in the patient's feelings? is the pain of the second tooth an exact repetition of that of the first, beginning in the same way and going through the same course? Because in that case *à priori* it would be probable that you were dealing with a case of local affection, and perhaps it would then be good policy to continue with the extractions. But this, as I have said, is one of the points which I only raise in order to learn your opinion.

Next suppose we take up the character of the pain and analyse its worth as a means of diagnosing the two conditions more clearly. And, first, as to the origin of the pain, where does it appear to arise first?

In the first case I spoke of the pain was described as arising in the bone. I find that in the majority of the cases the patient says it begins in the teeth, but in some cases it begins in the bone, and in



others in the skin. Some help may be obtained from observations of this kind. If the patient states distinctly that the pain begins in the bone, and from there goes to the teeth, may we not conclude that the disease is in the trunk of the nerve, and at all events after extracting one or two teeth, should we not stop and turn our attention to the trunk of the nerve? So also if the pain appears distinctly to commence in the skin and only subsequently affects the tooth, this would point to beginning in the trunk.

Finally, if the pain is primarily referred by the patient to the teeth, it may be due to them or it may not. It may be that the pain is referred wrongly, just as we feel pain in the little finger when we strike the ulnar nerve at the elbow.

And so we come to the next point, namely, *the mode of origin* of the pain. I suppose it is within the experience of all here that it is not always possible to find out from the patient what was the original cause of the mischief. One will say that it arose from a bad tooth, another that it was brought on by mental worry, another ascribes it to cold, another to injury, and so on. Certainly I have not yet been able to find any common mode of origin. But here again my experience is extremely limited, and I should be glad of further information. I think, however, that if the pain begins *gradually*, and there are diseased teeth

in the neighbourhood of the seat of origin as described by the patient, we may conclude that there is at least some probability that the teeth are the primary source of the mischief. But if the pain comes on *suddenly* it is more likely that the disease is in the trunk of the nerve.

Then with regard to the *character* of the pain. If it be constant it would seem in most cases to be of peripheral origin, whilst if it is intermittent the cause is more probably in the nerve trunk. But in a very severe case both constant and intermittent pain may be present at once, and consequently these distinctions may appear not to hold good. Thus in the last case I quoted, the worst I have ever seen, the neuralgic pain was distinctly intermittent. For a few minutes the patient had relief from it, though she still complained of a constant pain in the vertex of the head, due no doubt to the general neurasthenia. The point to determine is, of course, whether the primary neuralgic pain itself is constant or intermittent.

Fourthly, with regard to the exciting agents. If you find that the pain is brought on most commonly by *movement*, this would seem to be characteristic of affection of the trunk of the nerve. The patients on whom I have operated all stated that movement of the jaw specially brought on the pain. Opening the jaw to eat or to speak brought on pain; and I secured temporary relief to one of them by tying

up the jaw with carefully padded bandages. So far as I am aware, the effect of movement in causing attacks of pain is not so great in cases where this is due to peripheral irritation, and it must be obvious that the action of the muscles in opening or closing the jaws must press upon, and the movement of the bone must stretch and relax the nerve, and thus, if it be inflamed, give rise to pain.

I do not think we can attach much importance to the effect of other exciting agents. A patient will tell you at one time that cold brings on the pain, and at another that heat does, so that no general conclusions can be drawn from these facts.

Fifthly, I think that the *extent* of the pain is a very important indication. If, in addition to the fact that you have severe pain over the area of distribution of the nerve, you find also distinctly tender spots along the course of its branches, this is an indication that the whole nerve is in a state of hyperæsthesia, and that the primary source of the pain is inflammation of its trunk. We must, however, be on our guard against the several fallacies referred to before which may creep in here. This referred pain may, of course, easily have a peripheral origin.

Finally, I should like to make a few remarks about *Treatment*. I have endeavoured to lay before you very briefly the outlines upon which we can discuss the probable origin of the pain, and this,



of course, has a very practical bearing on the treatment. In a certain number of cases extraction of teeth, or the removal by other means of sources of dental irritation, may bring about a cure.

But as regards treatment in those cases in which extraction has not been followed by any lasting improvement. I have seen such cases treated by drugs, such as opium, ether, cocaine, croton-chloral, &c., but all fail sooner or later. One patient took opium to the amount of thirty grains per diem, and another took twenty-three grains, but at last it ceased to produce any effect. Alcohol will relieve the pain at first, but the effect soon wears off, and then it exacerbates it. I have tried subcutaneous injection of ether, but with the same result. Cocaine does better, but it also fails after a time. Croton-chloral has proved the most useful remedy I have yet seen tried. I may add that in some cases morphia seems actually to make the pain worse, and a practical objection to subcutaneous injection of all kinds in these cases is that the introduction of the needle is very apt to bring on an attack of pain.

With regard to surgical treatment. I think that experience has now made it clear that nerve-stretching should not be performed on the branches of the fifth nerve, although the results following its application to other nerves are very satisfactory. As regards the fifth nerve it offers just as many

risks as the operation of avulsion, and the pain invariably recurs. Avulsion, on the other hand, is much more successful—in fact, it generally cures. Of course I must not take up your time by dwelling upon the details to be attended to in carrying out surgical treatment, but allow me to say that from seeing the operation performed under different circumstances, I believe that success greatly depends on the efforts one makes to secure primary union. The cases in which the operation has not been successful have almost invariably been those in which the wound has been slow in healing. Of course I am referring to cases in which the whole nerve has been removed, and not to incomplete operations.

Lastly, as regards the effect of the operation on the parts and on the patient. Of course it was to be feared that the removal of the nerve might interfere with the nutrition of the parts supplied by it, but as a matter of fact I have not seen any bad effects follow. The areas supplied by the various branches of the fifth are really remarkably limited, that supplied by the infra-orbital nerve, for instance, is very small. Fortunately, also, the branches which are most often affected in this way are not those which supply the most important parts. The ophthalmic division of the fifth, the resection of which might be followed by serious trophic changes, being rarely the seat of mischief.

But I really came here to ask for information not to give it. The information I particularly wish for is respecting the character of the pain, the primary seat of the disturbance, the mode of onset, the cause of its excitement or origin, and the possibility of the affection of other branches of the nerve in such instances of the commencement of the evil as have come under your notice.

I have only been able in the time at my disposal to touch upon the principal points which seem likely ultimately to lead us to a full appreciation of the causation and pathology of this extremely painful affliction, but if these points relating to the earlier stages of the disease can be cleared up by the wide experience of the members of this Society, I think we shall make a very great step forward.

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## DISCUSSION.

The PRESIDENT said that though Prof. Horsley had stated that he had brought forward the subject with the view of obtaining further information, he (Mr. Tomes) would not take him at his word, but would prefer to ask him a few questions.

There was one fact in connection with these neuralgia cases which had always been a great puzzle to him, and one of which he had never been able to give a satisfactory explanation. He hoped Prof. Horsley might be able to throw some light upon it. He could never quite understand how it was that great relief was often obtained in these cases by doing the wrong thing, by doing something which subsequent experience of the case showed could not have touched the root of the evil. For instance, the first step would be to cut down upon the inferior dental nerve near the mental foramen and remove half-an-inch of it. This would very probably stop the pain for a few weeks. Then it returns as badly as before, so you drill into the canal and destroy the nerve in the neighbourhood of the lower wisdom tooth. This again gives relief for a time, but the pain recurs. It is evident that neither of these operations have reached the true seat of the mischief, yet what you have done has arrested the pain for the time being. He had in mind the case of a man for whom the nerve was first divided at the mental foramen. This gave him great comfort for a time; he was able to eat, talk, and shave without pain. But a relapse occurred, and the nerve was then destroyed by drilling into the inferior dental canal. This set him perfectly right for eight months, when the pain returned, and he came begging that the operation might be repeated. The drill was accordingly run down upon the nerve in the same place, but without doing any good. Subsequently, the patient went to Mr. Durham, who exposed the nerve by

dissection inside the jaw near its entrance into the dental canal and stretched it forcibly. This also did good for a time, but did not cure the patient, who was, however, afterwards lost sight of. The point he wished to put to Prof. Horsley was why the doing of ineffectual operations, such as the above or the extraction of teeth, so often did good, though subsequent knowledge of the case showed that they could not have reached the actual seat of the disease.

There were some cases published by Dr. Hodgkin, of St. Louis, which did not appear to be much known in this country, in which he drilled into the inferior dental canal from the alveolar border above it. About half of these appeared to have been successful, and the rest failures.

Then there were some operations by Prof. Pancoast, of Philadelphia, to which his attention had been called by Prof. Gross. Prof. Pancoast exposed the ascending ramus of the jaw, and trephining this, reached the nerve above its entrance into the canal, but he did not appear to have traced the nerve upwards as Prof. Horsley had done.

Prof. Horsley seemed to lay great stress on the trophic alterations which were seen in these cases as an indication that the mischief was in the trunk of the nerve. But these trophic lesions were by no means always met with. He had himself seen three cases of epileptiform neuralgia of great severity, in which these changes, if they existed at all, were so inconspicuous as to escape observation. One of these cases, of nine years' duration, a man who could not bear to have his lips touched without suffering acutely, was, to every one's surprise, ultimately cured by electricity.

There was one other point in Prof. Horsley's paper which he would refer to, viz., his suggestion that pain of an intermittent character was indicative of disease of the nerve trunk. He (the President) thought that all dental practitioners would be familiar with the fact that intermissions occurred in cases where the pain was clearly of peripheral origin; intermittent pain was indeed rather characteristic of mischief in the tooth pulp.

There was another class of cases with regard to which he

should be glad to obtain Prof. Horsley's opinion, viz., cases of neuralgia in edentulous jaws, which Dr. Gross cured by cutting out pieces of bone. He had been consulted by Mr. Canton with reference to a case of this sort, and advised drilling some holes in the bone which relieved the pain for a considerable time. This, of course, could only have done good by altering the nutrition of the part, or by counter-irritation.

MR. HENRI WEISS said he had only happened to meet with one well-marked case of this affection. The patient, a man, had perfectly sound teeth, and he suffered no pain unless something touched the right side of his face. Contact with the skin, and especially pulling the moustache, at once brought on a severe paroxysm of pain, attended with watering of the eyes, and injection of the skin.

MR. J. S. TURNER thought that the most important part of Prof. Horsley's paper was that in which he directed the attention of members to certain points in which they could help him in his endeavour to establish a diagnosis of this disease. He asked, in the first place, for further information as to the peculiarity of the special sensibility which occurs in patients suffering from this affection, the peculiarity consisting in the fact that the skin is exceedingly sensitive to soft touch, whilst the same amount of pain is not produced by hard pressure. The same thing was seen in the eye. The practised ophthalmic surgeon handled the eye in what appeared to be a very rough manner, yet he really caused the patient less pain than the timid operator who approached the eye gently. He (Mr. Turner) had often noticed that these patients would shrink when the skin was lightly touched in the neighbourhood of the painful spot, especially about the alæ nasi, and men had to give up shaving on this account. But if firm pressure was made the pain was not felt; the pressure seemed to obtund the pain. In the operation of nerve-stretching, as usually performed, there was a good deal of nerve-pinching, and he thought this nerve-pinching had probably as much to do with the destruction of sensibility as the stretching.



There were many obscure causes of pain in the teeth which rendered the diagnosis of its central or peripheral origin very difficult. He had in mind a case, which occurred many years ago in the practice of a well-known member of the profession, now deceased, in which intense pain was brought on by movement; when at rest the patient suffered little or no pain. A tooth was at length extracted, and in the canal was found a loose piece of secondary dentine, the movement of which when the patient moved had caused the pain.

He remembered reading a lecture by Prof. Marshall some three or four years ago in which a description was given, with a diagram, of the *nervi nervorum*, branches which, springing from the trunk of a nerve, ramify in its sheath and supply the nerve itself with sensation. It was the irritation of these, through their end-organs, which caused the pain in the cases referred to; and supposing one of these, springing from the inferior dental after it had entered the bony canal, to be irritated, this would in some measure account for the cessation of pain, referred to by the President, which occurred when the wrong thing was done, and its return when the nerve recovered its normal condition at the portion which had been surgically injured.

MR. STOCKEN said he had some time ago brought before the Society two cases of this disease which had come under his observation, but as they were so closely related to the subject under discussion, perhaps he might be permitted to mention them again. The first was that of a lady who had suffered for nine years from a very severe form of neuralgia. She could not speak without great distortion of the features, one eyelid drooped, the tongue was swollen, and the saliva ran out of her mouth. She could, however, always obtain relief by assuming the recumbent position, and she enjoyed occasional intermissions, so that she was free from the attacks during nearly half the year. Still they invariably recurred in spite of all sorts of remedies. She had tried sea voyages, galvanism, and homœopathy, without success. Seven teeth had been extracted, and the rest appeared to be per-

fectly sound. As a last resort, he recommended aconite and gelsemium, which gave her complete relief. She remained free from pain for two years, and although she had had occasional threatenings since, they had always yielded to the same remedies.

The other case was very similar as regards the symptoms. The teeth were sound with the exception of a canine, which was slightly carious and sensitive. He removed it and found the pulp completely disorganised, consisting almost entirely of an agglomeration of calcified bodies with only a trace of blood-vessels near the apex of the root. She was relieved for a time, but the pain returned as badly as before, and after living in suffering for some years she died.

MR. STORER BENNETT said he was not quite clear as to the exact nature of some of the questions which Prof. Horsley had put to the meeting. He understood him to say that he wished for information as to whether they were aware of any cases of trophic lesions of distant parts which were distinctly referable to the teeth? Then again he thought Prof. Horsley asked whether they were in the habit of noticing instances of pain referred to distant parts, but which was undoubtedly due to irritation in the teeth?

With regard to the first question, he had a very distinct recollection of a trophic lesion of that character in a girl who had suffered for many months from an ulcer of the cornea which had been treated without success by several surgeons. At last she applied to Mr. Nunn, at the Middlesex Hospital, who expressed an opinion that the ulcer was dependent on the delayed eruption of an upper canine tooth, and that it would disappear when the tooth was erupted, but not until then. And this proved to be the case, for when, in course of time, the canine was erupted, the ulcer disappeared.

With regard to the question of referred pain, he thought all must be familiar with the occurrence of painful spots due to dental irritation, but situated at a distance from the actual source of the mischief. Thus it was common to meet with a painful spot just in front of the ear in cases where

the pulp of a molar tooth was exposed or pressed upon, or whilst it was being treated with arsenic. Painting the surface with tincture of aconite would often relieve the local pain.

The President had referred to cases of nerve irritation in which treatment, which subsequent experience had shown to be wrong, had nevertheless given relief. This brought to his mind the case of a man, aged forty, but looking many years older, all of whose upper teeth had been extracted for neuralgia of supposed dental origin, but with only temporary relief. The gum was then incised, and the bone drilled into, but without any good result. Mr. Henry Morris then cut down upon the infra-orbital nerve and stretched it. The pain again returning, he opened up the infra-orbital canal and removed the nerve as high as the sphenomaxillary fissure. On examining the nerve after removal, Mr. Morris found on it some small fibrous nodules similar to those drawn by Prof. Horsley. This operation gave relief to the patient which the previous ones had failed to afford.

He quite agreed with the statement made by the President that intermittent pain was rather characteristic of local mischief in the teeth than of a lesion in the nerve trunk, and that it could not therefore be relied upon in the way Prof. Horsley had suggested as an indication of the mischief being deep instead of peripheral.

MR. S. J. HUTCHINSON said that, following the President's example, he proposed to catechize Prof. Horsley still further. He should be glad to know what was the exact nature and position of the changes which he found in the portions of nerve which he removed? Did he find any calcareous degeneration? Could he say that there was a distinct local change in the structure of the nerve from that which it would present in a healthy state? In the cases he had mentioned, was the pain confined to the inferior dental, or did it affect other branches of the fifth nerve? Was there in these cases any history of diseased teeth? And if the teeth appeared to be sound when removed, were any of them found to contain deposits of secondary dentine?



He thought that if a nerve became inflamed, the evidences of irritation would probably be more marked in that part which was contained in a rigid bony canal than they would be elsewhere. The branches of the fifth, which gave rise to the most severe suffering, the infra-orbital and inferior dental, both passed through bony canals, and it seemed to be clear that there was no prospect of curing the neuralgia except by operating on the nerve above this part of its course. But what was the original cause of this irritation? Was it really peripheral or central? He was disposed to think that it was in most cases peripheral *at the outset*, and that it spread upwards, affecting the nerve higher up later on. It might arise from calcification of the tooth pulp, from pressure produced by the cicatrix after the extraction of a tooth (which had been shown by Prof. Gross to be a not uncommon cause of persistent neuralgia), or to irritation set up by decayed or misplaced wisdom teeth. Had Prof. Horsley met with any evidence which would lead him to favour this view?

MR. BETTS said he could adduce from personal experience evidence in support of the statement that peripheral irritation might cause pain far away from the actual seat of irritation. He suffered at one time from supra-orbital neuralgia, which continued for six months in spite of medical treatment, and he was quite at a loss to account for it. At last an upper lateral incisor became tender. He had the nerve extirpated, and the neuralgia was at once cured.

MR. ASHLEY BARRETT remarked that there were two classes of cases in which it was common to meet with "referred pain." It was frequently met with in cases of decay in a wisdom tooth; the pulp might be actually exposed, yet the patient did not complain of pain in the tooth, but of pain in the neighbourhood of the ear or near the temporo-maxillary articulation. But if the tooth was extracted, the pain was at once relieved. The other class of cases were those in which a portion of the pulp of a sound tooth died, and gas collecting in the pulp cavity, exercised pressure on the

living part of the pulp, and gave rise to pain at a distance which might easily be attributed to some lesion of the trunk of the nerve.

PROF. HORSLEY, having been called upon by the President for his reply, said he had first to express his thanks for the knowledge of many important facts which he had gained during the discussion. He had been invited to give almost a second paper; it was of course impossible for him in the time at his disposal to answer fully all the questions which had been raised, and he would therefore only refer to one or two points which he had not made clear.

First with regard to the undoubted fact that an operation upon the extremity of the nerve might give relief for a time, even though it evidently did not touch the seat of the mischief. The operation in this case might conceivably act in one of two ways. It might act by strong "counter-irritation" at the end of the nerve. Prof. Gross' operation of drilling belonged, he thought, to this category. Or it might be, as Mr. Hutchinson had suggested, that in some of these cases the mischief began peripherally and extended upwards along the nerve, a creeping peripheral neuritis, which to judge by analogy was quite possible. If so the successive extirpation of the peripheral portions of the nerve would give temporary relief.

The President had remarked that trophic lesions might be absent even in some severe cases in which the nerve trunk was involved. He was aware of this,—it had been so in one of his own cases,—and he had no explanation to offer.

It was of great interest to him to learn that the severe pain due to inflammation of the pulp might be distinctly intermittent,—suddenly and completely disappearing and then recurring again,—presenting in fact the typical epileptiform character. This fact certainly increased the difficulties of early diagnosis considerably.

With reference to Mr. Hutchinson's question as to the condition of the teeth in his cases when they were extracted, he was sorry that he could give no information. The patients did not come under his notice until a long time after the

teeth had been removed, in one case not till seven years after, whilst the shortest interval was three and-a-half-years. As regards the question raised with reference to the wisdom teeth, this was just one of the points upon which he came to ask for, rather than to give, information.

The cases mentioned by Mr. Stocken were extremely valuable; it was of great interest to him to learn that after so long a duration as nine years of suffering a severe case could be cured by drugs.

With respect to Mr. Storer Bennett's case of ulcer of the cornea, he was aware of many published cases of disturbances of distant parts produced by peripheral irritation, but not necessarily trophic. The question he wished to ask with regard to instances of trophic changes was, under what circumstances do these occur most commonly? If you have a case of severe neuralgia (so-called) distinctly due to disease of the teeth, do you find trophic disturbance? He suspected that this would be answered in the negative.

Then again with reference to "painful spots." He was well acquainted with "referred pain,"—indeed he had observed it in himself,—but though this might be accompanied by a certain amount of local tenderness, there was not the extreme sensibility to local pressure which was met with in the cases of neuralgia of the nerve trunk to which he had referred.

As to the changes found in the portions of nerve which he had removed, there was in all cases great overgrowth of fibrous tissue in the nerve, or what was generally called *sclerosis*. This lesion was evidently the result of chronic inflammation. He believed that the origin of the mischief was generally in that part of the nerve which was contained in the bony canal, and it was on that account that he proposed that the nerve should be divided and removed above that part of its course.

As to the possible causation of the disease he could not say anything; this was another of the points on which he sought information.

He would only add that the operation which he had described was not so severe as it sounded. In proof of this



he would hand round a photograph of the second case taken five days after the operation, and showing the wound healed. Of course without antiseptic precautions these operations would be very formidable, and perhaps hardly justifiable, but thanks to the teaching of Sir Joseph Lister and others, the risks were not such as to cause much anxiety.

The PRESIDENT said he had great pleasure in conveying to Prof. Horsley the thanks of the Society for his able and suggestive paper on a subject of great practical interest to the dental profession. He trusted that before very long a satisfactory solution might be found to this difficult question in diagnosis, which had been hitherto somewhat of an opprobrium to both surgeons and dentists alike.

A cordial vote of thanks was also due to Mr. R. J. Larking for the valuable collection of fossil teeth which he had presented to the Society, and also to Messrs. Henri Weiss, Storer Bennett, Bridgman, and other contributors of Casual Communications.

The next meeting of the Society would take place on Monday, November 7th, when they were promised a paper by Mr. J. Bland Sutton on "Odontomes," together with other business of which due notice would be given.

The Society then adjourned.

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CORRIGENDUM.—On page 262, May number, last line, for "*and in doses*" put "*which with doses,*" &c.

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